SCIENTIFIC AMERICAN

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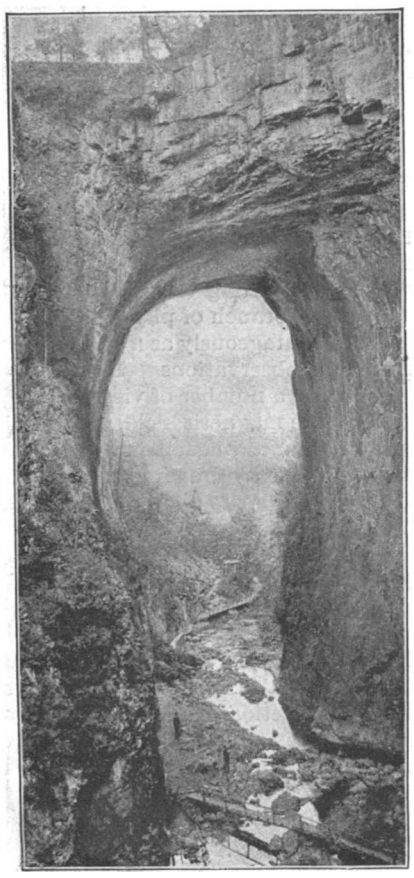
NATURAL RESOURCES OF VIRGINIA AND WEST VIRGINIA.

BY B. G. UNDERWOOD.

In natural and varied resources, Virginia and West Virginia are unrivaled, and the marked advance made by both of these commonwealths during the past decade is worthy of note.



Virginia, as one of the original thirteen States, held first position up to the census of 1810, and, owing to the separation of West Virginia, in 1863, was No. 10; 1880, No. 14; and in 1890, No. 15. West Virginia gained one point in the last census, being No. 29 in 1880 and No. 28 in 1890.

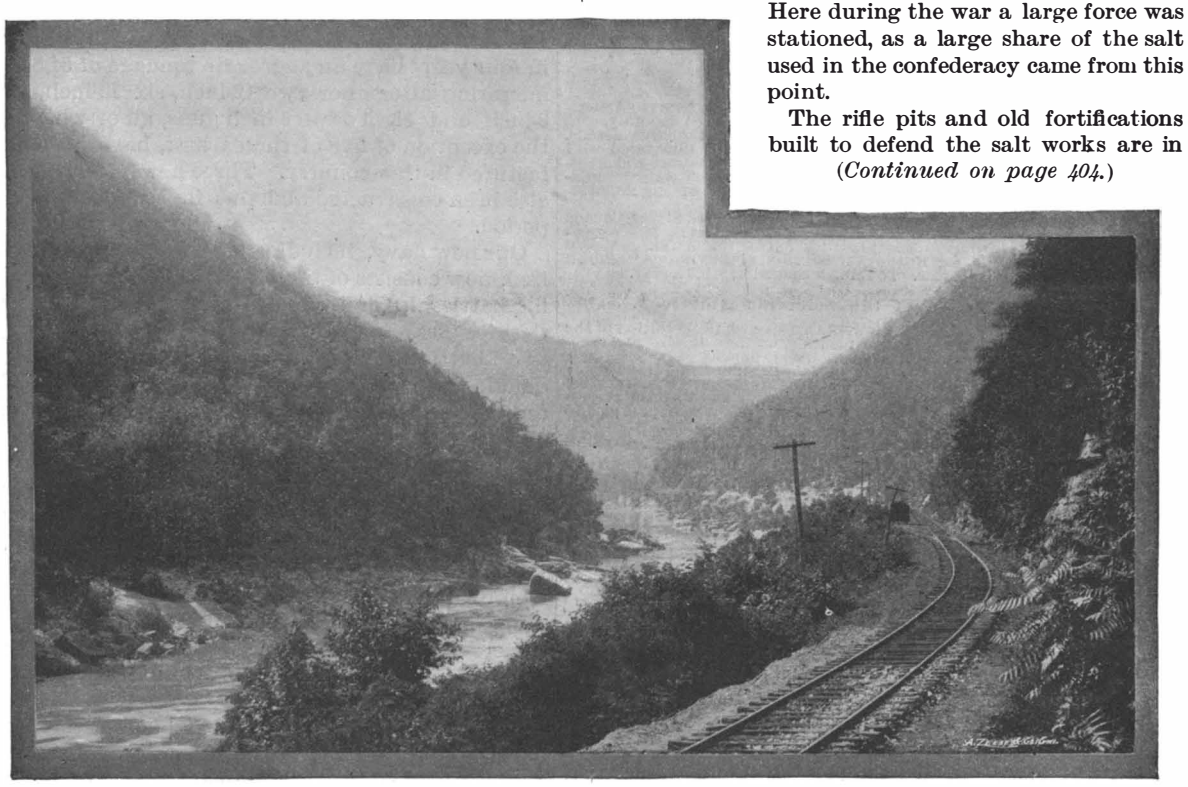
We have preferred in the present article to show a few of the many beautiful views with which both States abound, rather than any of the many manufacturing establishments which have lately been so largely established.

On this page is given one of many beautiful views on New River near Thermal, West Virginia, on the line of the Chesapeake and Ohio Railroad.

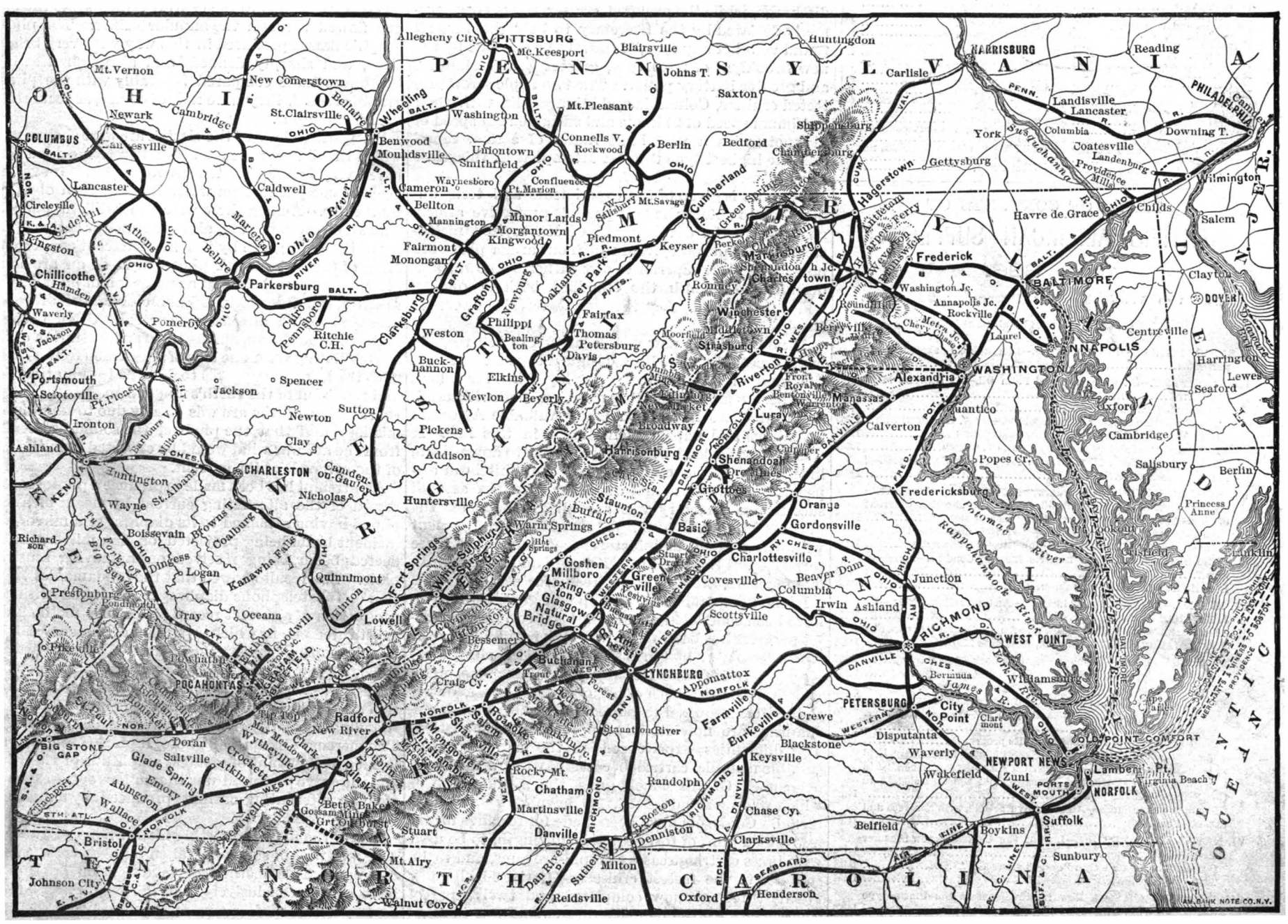
Saltpeter Cave, which has a peculiar history, is given on another page. From this cave the confederate government obtained niter for use in manufacturing gunpowder, and it was guarded during the war. It is situated near Natural Bridge, and below the mouth of the cave the little stream flows which runs under Natural Bridge. Saltville, Virginia, is also shown. Here during the war a large force was stationed, as a large share of the salt used in the confederacy came from this point.

The rifle pits and old fortifications built to defend the salt works are in

(*Continued on page 404.*)



ON NEW RIVER CHESAPEAKE AND OHIO RAILROAD, NEAR THERMAL, W. VA.



VIRGINIA AND WEST VIRGINIA—INDUSTRIAL TOWNS AND CITIES, RAILROAD TRUNK LINES AND STEAMSHIP ROUTES.

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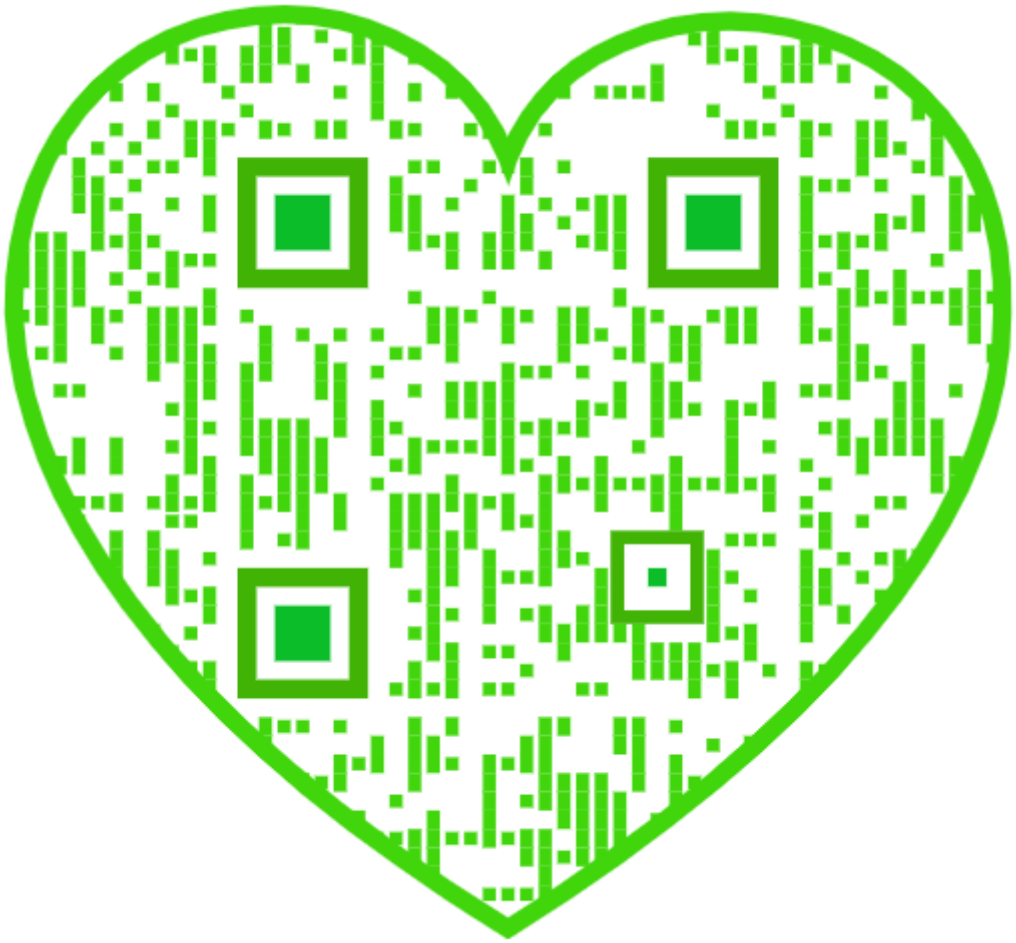

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PROGRESS OF OUR NAVY.

It is gratifying to note the very substantial progress which has been made, as evidenced in the annual report of Secretary Tracy, in the building up of our new navy. It is, as the secretary says, "a progress both in ships and in ordnance, by which the United States has emerged from its condition of helplessness at sea, and, by the employment of its own resources, has distanced its more experienced competitors, marking an epoch in the naval development not only of this country, but of the world."

On March 4, 1889, there were in our navy only three modern steel vessels, with an aggregate tonnage of 7,863 tons, and mounting thirteen 6-inch and four 8-inch guns, the forgings for which last, as well as the shafting for the vessels, had been purchased from abroad, as they could not be made in this country. On the 4th of March next it is expected that there will be twenty-two modern vessels in commission, while nine additional vessels, none of which in speed, armor and armament has a superior in any foreign navy, promise to be ready for launching within the next twelve months. The nineteen vessels thus added to the navy in four years have an aggregate tonnage of 54,832 tons, mounting altogether two 12-inch, six 10-inch, sixteen 8-inch and eighty-two 6-inch guns, all of which, with the exception of five of the earliest, have been manufactured in this country. Three new steel tugs have also been constructed and put in service during this period.

Our new navy, including all vessels built or authorized, now consists of the following vessels: One seagoing battleship (first-class)—Iowa; three coast-line battleships (first-class)—Massachusetts, Indiana, Oregon; two battleships (second-class)—Maine, Texas; six double-turreted harbor defense vessels—Puritan, Monterey, Miantonomoh, Monadnock, Terror, Amphitrite; two armored cruisers—New York, Brooklyn; one ram; two protected cruisers of extreme speed—Columbia, Minneapolis; fourteen cruisers—Olympia, Baltimore, Chicago, Philadelphia, San Francisco, Newark, Charleston, Boston, Atlanta, Cincinnati, Raleigh, Detroit, Montgomery, Marblehead; one dispatch vessel—Dolphin; six gunboats—Yorktown, Concord, Bennington, Machias, Castine, Petrel; one dynamite vessel—Vesuvius; one practice vessel—Bancroft; two torpedo boats—Cushing, No. 2. Making a total of forty-two vessels.

The three great first-class battle ships have a displacement of over 10,000 tons each, are protected by 18 inches of armor, carry 13-inch guns, and throw an aggregate of over three tons of projectiles at a single discharge, while the armored cruiser New York, formerly declared by the Secretary to be "the best all round vessel of any type," is now to be outdone by the new Brooklyn, of 9,150 tons, greater coal endurance and greater battery power. The two triple screw protected cruisers, Columbia and Minneapolis, with their maximum speed of 22 knots and sustained sea speed of 21 knots, with a very large radius of action, represent the highest type thus far attempted in this class of vessels.

A *resume* is given of the experiments and tests undertaken to obtain the best possible protective armor, resulting in the development of Harveyized nickel-steel for this purpose, from which our armor plates are now made, "far superior to any hitherto known, and destined to furnish the standard, both of quality and manufacture, for the great naval powers of Europe."

Although all our new vessels, as well as the torpedo boats especially, have been designed to use torpedoes, the kind of torpedo to be employed has for a long time been a most perplexing question, nothwithstanding that there have been many valuable American inventions and improvements made in this line. It was finally decided by the department to domesticate in this country the manufacture of the Whitehead torpedo, whose use in actual war had proved an assured success, and a factory was accordingly built for the purpose in Brooklyn, N. Y., under an arrangement with the foreign manufacturers. A number of these torpedoes, of the best modern design and of American manufacture, are now nearly ready for use.

In the manufacture of high power guns, eighty-two have been completed during the last year. The greatest progress has been made with the rapid-fire gun, of which twenty-eight 4-inch and eleven 5-inch have been completed since the last report. These guns, upon which little had been done up to last year, owing to the time required to perfect a suitable breech mechanism, are now rapidly approaching completion. The difficulties experienced in the manufacture of suitable metallic cartridge cases have now also been overcome. Of the 6-inch guns, the manufacture of which was most advanced, 135 have now been completed. Contracts have been made for forgings for six new 6 inch guns of forty calibers in length, to be used with brass cartridge cases as rapid-fire guns, and to be supplied to the fastest cruisers. Of the 8-inch guns, twenty-three are now completed and twelve partly completed. All the 10-inch guns, twenty-five in number, have been completed and are ready for installation on the ships for which they are intended. Five 12-inch guns have been completed, of which two have been proved and are being installed on the Monterey. The first 13-inch gun is approaching completion, and the forgings of the second have been received.

The development of a new smokeless powder, and of a safe high explosive for the shells in high-power guns, and the manufacture of armor-piercing projectiles equal or superior to those of any other nation, are each the subject of a discriminating and most satisfactory notice by the secretary. As to smokeless powder, it is said that the department, "by independent investigation and experiments, conducted by its own agencies at its own establishments, has succeeded in developing a smokeless powder which in efficiency and endurance gives better results than any known powder abroad." In conclusion, the secretary expresses the opinion that there can be but little doubt, in view of the progress of naval science, that the advance toward higher and higher types will continue steadily in the future, a progress in which American inventors will, doubless, be full participators.

THE USE OF PHOTOGRAPHY IN PHYSICAL RESEARCH.

This is the title of a very interesting and instructive lecture delivered before the Physical Department of the Brooklyn Institute of Arts and Sciences, Dec. 13, by Prof. Edward L. Nichols, of Cornell University.

The lecturer began by stating that photography is now used in almost every branch of physical research; that it is often used advantageously as a substitute for drawing when making observations. Prof. Nichols projected upon the screen a number of views, illustrating the exploration of the magnetic field, showing the lines of force, and of various phenomena which have heretofore been illustrated by drawings made by the hand of the observer. In some cases the hand-made drawings compared favorably with the photographs, while in others they appeared to be incorrect. The lecturer spoke of the value of photography in making long-continued observations; also in making observations of phenomena developed instantaneously, as in the case of lightning flashes, electrical discharges, sound vibrations, etc. He also showed upon the screen a plate illustrating diffraction fringes formed by a small triangular aperture in a piece of tinfoil, the figure being very intricate, and altogether different from what might have been expected.

An interesting illustration was that of photographs of the manometric flame, the flame for this purpose being produced by a concentric burner, the illuminating gas being supplied to the central orifice while the oxygen flowed through the annular orifice. The photographic flames produced in this way were very bright, clear, and sharply defined, and although drawings heretofore made compared favorably with the photographic record, they were not, of course, as accurate as the photographs.

Interesting views of the electric arc were shown, with which the hand-made drawings heretofore used compared very favorably. The photographs, however, revealed some phenomena which had not been observed by the eye. Among these were the brilliant particles thrown off from the arc, also the superior actinic quality of the light given by the incandescent copper covering of the carbons. A photograph of an arc on an alternating circuit showed a succession of light flashes, proving the intermittent character of the arc when produced by an alternating current. Other peculiar features were shown, among them an illustration of the arc oscillating from one side of the carbon to the other. This the lecturer supposes to be due to the attraction and repulsion of the earth's magnetism. He stated that the singing of the arc was clearly due to rapid intermissions, and that the pitch of the sound proceeding from the arc was what would be expected from the rate of the reversals of the current.

An attempt has been made to produce a photographic record of the alternating current by means of a telephone having attached to its diaphragm a mirror, the incident beam being projected on the mirror, the reflected beam being received on a moving sensitive plate. The result showed that the fundamental vibration of the telephone diaphragm interfered with the production of a correct record. For this method was substituted one in which a stream of mercury carried the alternating current, the apparatus being so arranged as to allow the stream to pass between the poles of a magnet. The mercury was oscillated by the attraction and repulsion of the magnet, the movement correspondingly exactly with the reversals of the current. The mercury stream was photographed through a slit located at the point of greatest amplitude of vibration, and the curve produced was the sinuous curve expected from an alternating current produced by a machine working normally.

One of the most interesting illustrations of the evening was that of sun spots taken by means of the spectroscope. This method of investigation appears to have shown conclusively that the fecula around the dark portion of the sun spot correspond with the flames projected from the sun.

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American Society of Mechanical Engineers.

Papers of more than usual interest and containing much original and important matter were read at the recent meeting in this city. In a paper, an Analysis of the Shaft Governor, the remarkable fact was brought out that, notwithstanding the great importance of the governor as a means of protection from accident, not to mention its other uses, not a single complete work, treating of this, either descriptive or scientific, has ever been brought out.

[Readers of the SCIENTIFIC AMERICAN will recall the series of fly-wheel breaks during the past year, a notable one in the Amoskeag mills at Manchester, N. H., in all of which the governors failed to prevent the racing which led to disaster.]

The author of the paper described a governor of his own construction, which, if it will work with certainty under all conditions, is a remarkable design. After a mathematical description of the forces involved, and his mode of dealing with them, he says of the mechanical result, that is to say of the new governor:

"At a recent test of the device in an electric light station, on an engine of 500 horse power, running at a speed of 220 revolutions per minute, where the balance found it necessary to resist reciprocating pressures of 2¹ tons at each extreme of the stroke, there was not even one revolution difference between the corresponding speeds of no load and full load."

John T. Hawkins, of Taunton, Mass., described a new graduating steam radiator which he had been led to design because of the well-known defects of those now in the market. He said:

"The impossibility of adjusting the heating effect of the ordinary steam radiator to changes in the temperature of the outer air is probably the greatest objection to that system; the facility with which this adjustment is effected in the hot water systems constituting the principal advantage which the latter possess over the former; while the simplicity and perfection with which the combustion in the furnace is automatically regulated in the steam system gives it an equally decided advantage over the hot water system; to say nothing of the greater first cost of the latter."

His own design was operated in his own apartments last winter, working admirably (that's what he says of it), giving all needed relief from an overheated room in mild weather, while giving ample warmth when the thermometer ranged low. It also conclusively established its immunity from leakage when, upon a second occasion, the attendant upon the boiler forgot to shut off the boiler feed and filled every radiator in the house with water, this being the only one out of nineteen that was not discharging water pretty freely about the floors from the automatic air valves, until the surplus water was drawn from the system through the boiler blow-off cock.

An elaborate and lengthy paper was read by George Richmond, of New York, on the Refrigeration Process and Its Proper Place in Thermo-dynamics. We may sum it up by saying that the fundamental principle insisted upon is that heat can leave a body only by transformation into work or by transfer to some other body. The graphical method, though it can give no information as to the actual transfers between the steam and the cylinder, is peculiarly adapted to the representation of such transfers. This subject is merely touched upon in an application of the principles to the study of the practical refrigeration process, the object of the paper being principally to present a method which it is believed will be found peculiarly useful to those who are not familiar with the analytic methods and in sufficient completeness to enable a judgment to be formed as to its merits.

The mathematical formulæ introduced are in a large measure due to the translation of the results into the usual notation, and there are few questions arising in practice, so the author says, which a draughtsman could not solve in an intelligible and accurate manner by the methods with which he is most familiar. One noticeable result is the graphical determination of the amount of superheating required to produce any degree of dryness finally in the steam cylinder (apart from the action of the walls) or the superheating of a vapor by compression—results for which Zeuner's formula for superheating gases is generally used. The value of this formula is not in question, so says the author, but as a general principle it is unsatisfactory to use formulæ on trust when we can reach the same results directly by easily understood methods.

In the paper, Tests on the Triple Engine at the Massachusetts Institute of Technology, these tests having been a part of the regular work in the laboratory of steam engineering for the last school year, the conclusion reached is that "it makes but little difference where steam jackets are used on an engine, provided the jacketing is carried far enough and not too far."

This is certainly a remarkable conclusion and seems scarcely to compensate for a season's work.

A Variable Speed Steam Power Transmission, the invention of E. F. Gordon, M.E., was described with much detail. Simply stated, the device consists of a deeply grooved pulley, split by a plane perpendicular to its axis and dividing it symmetrically, with means for varying the distance of the two parts, one from the other.

Given a belt adapted for the purpose, it will, in running on such a pulley, lie nearer the center as the two parts are more widely separated, and recede as they are brought nearer together. Such a pulley may be used on either the driving or driven shaft, or both, and it is evident that the shafts may be at any practical distance apart, also that the greater the pull on the belt the greater its hug and consequent freedom from slip. In some cases it is desirable to place a loose pulley between the two parts referred to, making a compact arrangement for starting, stopping, and varying speed in the space ordinarily occupied by a single pulley of the usual style.

W. F. Durand, of Ithaca, N. Y., read a paper on the Limit of Propeller Efficiency as Dependent on the Surface Form of the Propeller, setting forth the result of a long series of studies and some striking formulas by which he endeavored to show:

(1) That the limiting efficiency of the element of the surface of a propeller, working under any given conditions, is an absolute geometrical quantity, depending solely on its direction and motion, and on the motion of the ship.

(2) That the limiting efficiency of an entire propeller, composed of helicoidal surfaces of the same uniform pitch, is equally simple and definite.

(3) That the limiting efficiency of propellers in general, whether considered as surfaces not truly helicoidal or as solids such as are actually used, depends on the additional consideration of the distribution of work over their surfaces. The latter being a subject of great complexity, and depending on the ship as well as on the propeller, does not admit of general analytical treatment. It is shown, however, that certain limits may usually be laid down between which the efficiency in any given case must lie; and in the case of solids, as actually used, it is shown that such suppositions as can be made lead to the natural conclusion that thickness in general is detrimental to efficiency.

Samuel Webber, of Charlestown, N. H., gave the tabulated result of some interesting Tests of Driving Belts, the result of the tests. The strain on the belts was 83⅓ pounds per inch, though at times it exceeded this somewhat. Summing up, the author said:

"The 'leather-lined canvas' belt gave excellent results, as before, but its opponents object to it from the difficulty of making perfect joints by lacing; and the 'slotted' leather belt called the 'Eureka,' when dressed so as to be perfectly supple, gave very nearly as high results, and showed about the same coefficient of friction, which diminished a little in the last test, when the strain was increased from 83⅓ to 91⅔ pounds per inch."

An interesting boiler explosion was the subject of a paper by F. Daniels, of Worcester, Mass., describing the precautions taken by the owners of the mill by whom he is employed to secure sound material for a new set of horizontal tubular boilers, subjecting all the plates to a careful test before they were made up; and how that even then some of them proved to be weak, and a rupture (mistakenly called "explosion") occurred. The author said: "These boilers have been in successful operation for nearly six years and are still in use. They are inspected every week. The water is run out, the manholes removed, and the interior as well as the exterior of the boilers carefully examined. As the water in the streams in the vicinity of Worcester is very pure, coming as it does from the granite hills, we never find scale in the boilers, but in the spring and fall during high water it is not uncommon to find a small deposit of debris, which is carefully washed out.

"With all this care, the accident was to us a real surprise. When it happened, the plant was running as usual, but the boilers were somewhat forced, although not to any extreme limit. Without any warning whatever, and with very little noise, the firing doors of the furnace were burst open, coal, ashes and water thrown out, and the boiler house, in an instant, filled with steam.

"As soon as an examination could be made, it was found that one of the plates in the third row, just over the most intense heat, had bagged and ruptured, leaving an orifice about one inch in diameter, thinning the metal around the orifice to a knife edge. The remainder of the shell was not damaged, because the boiler quickly emptied itself of water and steam, which extinguished the fire and cooled the brickwork. The analysis of the ruptured plate is as follows:

Phosphorus	0·063 per cent.
Sulphur	0·022 "
Silicon	0·024 "
Manganese	0·261 "
Carbon	0·10 "

"It was suggested that this thin scale covered the entire surface over the fracture before the rupture, and was caused by oil which had become burned onto the plate; but as the feed water for this plant was supplied from a closed heater, it is difficult to see how oil could have found its way into the boiler. We have been informed by Mr. Robinson (who made the boiler) that he was called a short time ago to examine a boiler of the same construction as the one referred to in this paper. It had been overheated directly over the fire box, making the shell plates wavy. After carefully drawing the water from the boiler, nothing could be discovered on the plate excepting a whitish powder. There was neither scale nor mud.

"The conclusions the writer arrives at are that the importance of mechanical, physical and chemical tests cannot be overrated. While the plate makers invariably subject their plates to tests and stamp them accordingly, at the same time a confirmation of quality by the consumer is desirable, for we have seen that in the tests at Watertown one plate was condemned. If the ruptured plate had been of improper material or had contained sufficient carbon to harden when the water came in contact with the overheated plate, a crack might have developed, resulting in a serious explosion, possibly destroying the entire plant and causing a loss of life."

In the discussion that followed the reading of this paper, J. McBride, an experienced boilermaker, gave it as his opinion that dirt caused the trouble. J. F. Holloway, another expert, attributed it to a blister or air bubble in the plate. Geo. H. Babcock, the boilermaker, said: "The dirt will gather at a definite point; it will not spread over the bottom of the boiler, the circulation tending to bring it toward one point, where it will gather in a mass and cause a burning out."

Professor Denton said: "It has been shown that a scale of very small thickness, which would ordinarily escape the attention of a boilerman, would cause this result."

The Process of Cutting Cams, was read by W. A. Gabriel, of Elgin, Ill. Mr. Gabriel is a designer of small and intricate machinery for the manufacture of parts of watches and, in the course of his experience, found it necessary to produce cams of greater accuracy than could be obtained by the old and well known ways.

A paper on Tests of a Pump Receiving Suction Water under Pressure, described a series of experiments made with a view of determining the advantages of the plan of feeding water under pressure to a direct-acting pump over that of drawing the water from a receiving well. No measurement of the water pumped under the two conditions was attempted, as it went directly into the supply pipes; but the pumps appeared to work more smoothly and to keep the stand pipe level more constant under pressure than when sucking.

Experimental Determination of the Heat Generated per Candle Power by Oil and Gas Lamps, was the title of a paper read by D. S. Jacobus, of Hoboken, N. J. J. B. Stanwood, of Cincinnati, O., treated Strains in the Rims of Fly-band Wheels, the conclusion being that this strain varies nearly as the rim velocity squared, and, if the velocity is doubled, the strain is quadrupled and the factor of safety is reduced to a minimum.

A highly instructive series of experiments was described by R. C. Carpenter, of Ithaca, N. Y., on Comparative Variation in Economy with Change of Load in Simple and Compound Engines, Effect of Steam Jackets on High Speed Engines. By the use of diagrams, the author was enabled to show the actual results obtained very clearly. From these it appeared that for most conditions the engine with the cylinders steam-jacketed consumed less than when not jacketed; that this difference was greatest for the least loads, was probably about 2 per cent at rated capacity, and the conditions were reversed for heavy loads, the unjacketed cylinder becoming the more economical.

Considering these results only for loads between 60 and 120 horse power, the author found as the average:

With steam in jackets....	19·10 pounds of dry steam per I. horse power per hour.
With no steam in jackets.	20·1 pounds of dry steam per I. horse power per hour.

These tests, the lecturer said, show in all cases a slight gain due to the use of the steam jackets, the amounts varying in the different tests to from 2·75 per cent to 5 per cent of the steam consumed. The use of the high pressure jacket alone seems to have produced no especial effect, the results being better without it.

It should also be noticed, as pointed out by Dr. R. H. Thurston in Paper CCCCXXV., Vol. XII., of the Transactions, that in actual use the jackets would produce somewhat better results than shown in the test, due to the fact that the water of condensation from the jackets would ordinarily be returned directly to the boiler, thus saving the heat required to raise a given weight of feed water through the required range of temperature.

Strains in Lathe Beds was the title of a paper read by G. W. Bissell, Ames, Iowa. De Volson Wood read one on Hydraulic Reaction Motors and another on Negative Specific Heat.

TELESCOPIC steel masts or rods are to be used in lighting the public squares in Brussels. The object of this system is to preserve the beauties of the parks in the daytime.

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Telegraphing Without Connecting Wires.

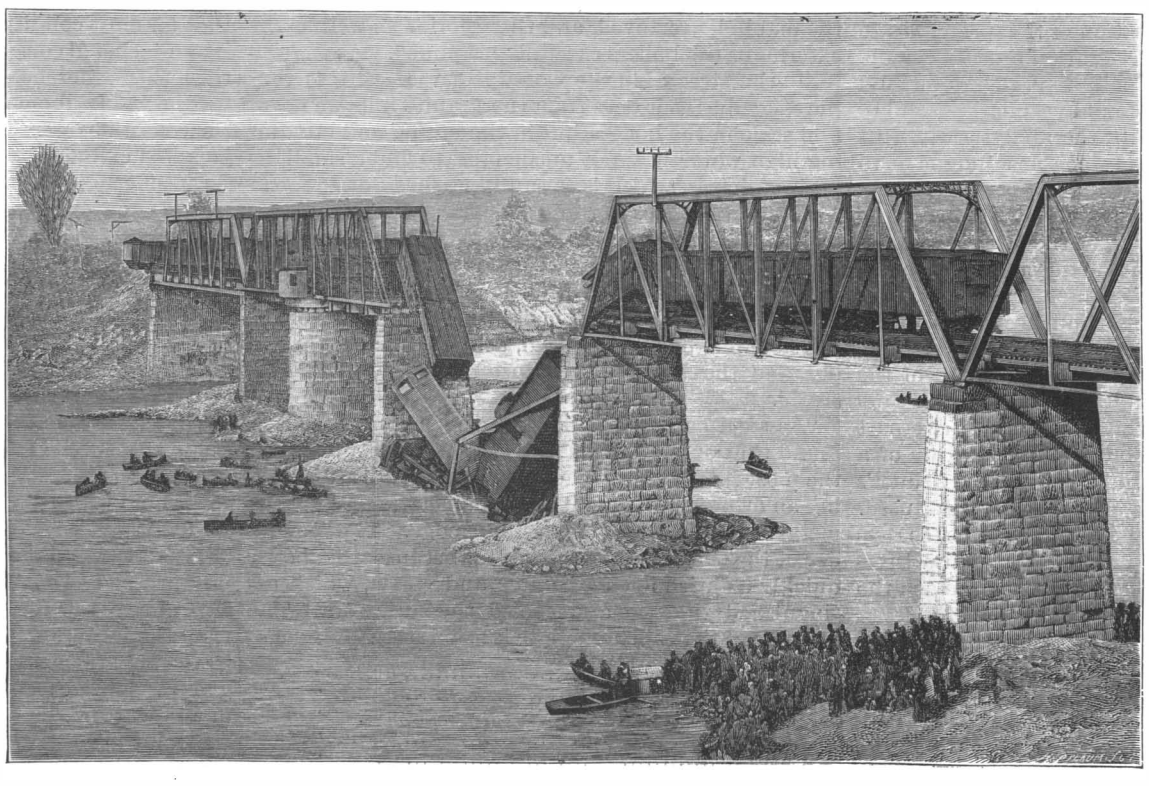
Interesting experiments have recently been made under Mr. W. H. Preece, with a view to electric communication between distant points without wire connection, namely, through air, water, or earth. Mr. Preece proposed to conduct experiments in three different methods. First, by running a wire along the shore on light poles for a distance of about a mile, and a second wire from stem to stern of the ship, the two acting upon each other inductively through the intervening space; secondly, by suspending a short line over the side of the ship, so that it might dip into the sea in the direction of the end of the shore line, to work by conduction through the sea; and, thirdly, by running out a light cable from the shore to the ship, terminating in a coil at the bottom of the sea, near the ship, but not attached to it, while another coil is placed on board. These two coils are expected to act inductively, and to give ample sound on telephones by means of rapid alternations. The experiments by the first method have been carried to a successful issue within the last few days, the shore wire having been erected along the Welsh coast, commencing at Lavernock Point, a little south of Cardiff, and proceeding for a mile in the direction of Lavernock House. The lightship was represented for the occasion by the island of Flat Holme, in the Bristol Channel; and the line there erected, parallel to the first and three miles distant from it, was about half a mile long. The shore line was furnished with a powerful generator at Lavernock Point, and the island line with a sounder to receive the messages. The result was that the words dispatched into the mainland wire were heard on the island with perfect distinctness, but we can scarcely admit that Flat Holme represents the conditions of a ship. This method is analogous to that patented by Mr. Edison for establishing telegraphic communication between two vessels when at sea.

Society of Naval Architects and Marine Engineers.

Prominent men in the shipbuilding and shipping interests of the United States have completed the preliminary organization of a professional society, to be called the Society of Naval Architects and Marine Engineers, whose object will be to promote the art of shipbuilding in all its branches, both commercial and naval. The committee of organization, consisting of William H. Webb, of New York; Lewis Nixon, general manager of Cramp's Shipbuilding Company, of Philadelphia; Col. E. A. Stevens, of Hoboken; Francis T. Bowles, Naval Constructor, United States navy; and (*ex-officio*) Clement A. Griscom, president of the International Navigation Company, expect to incorporate the society in New York and are now sending out invitations to membership.

FALL OF A RAILWAY BRIDGE AT TERRE HAUTE.

Our engraving is reproduced from a photograph showing the very serious consequences which resulted from a rather slight butting collision at Terre Haute, Ind., on October 28. The bridge, which carries the track of the Cleveland, Cincinnati, Chicago and St. Louis road, crosses the Wabash River at an elevation of about 50 feet above the water. The cars which appear at the right of the engraving were those of a train which had been run upon the bridge for a few minutes to get out of the way of another train, switching in the yard. While it stood there it was run into by the stock train from the opposite direction and a truss was broken sufficiently to cause it to give way, letting both engines and eight cars of cattle and coal into the river. One of the engines was entirely submerged. One engineer was killed. The other men on both trains saved themselves. The published accounts indicate, so says the *Railroad Gazette*, that there was fault on both sides; that the brakeman of the standing train did not go far enough with his flag, and that the approaching train was running too fast.



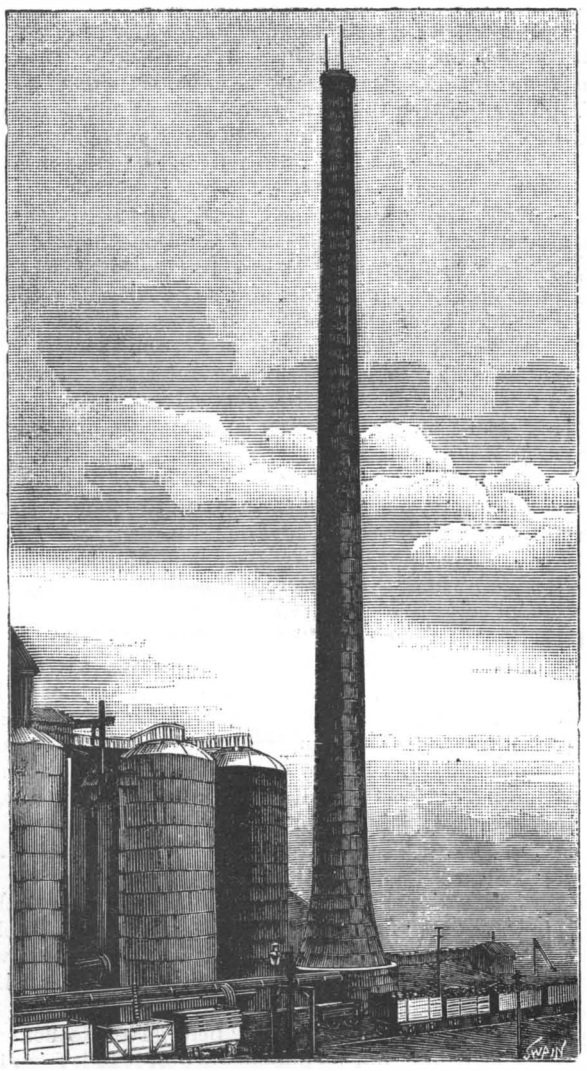
FALL OF A BRIDGE FROM COLLISION.

Morley's Polishing Paste.

Made by calcining flint and grinding the calcined material to a very fine powder, then mixing with fat, oil, or other such liquid to make a suitable paste, which "is put up or sold preferably in tins or boxes," and on the application of a little moisture is ready for use." For cleaning glass the levigated flint is sold dry to be used with water.

THE TALLEST WROUGHT IRON CHIMNEY.

The annexed illustration is from a photograph of a large wrought iron chimney, erected at Darwen, in North Lancashire, by the Pearson & Knowles Coal and Iron Company, of Warrington, for the Darwen and Mostyn Iron Company. It was designed, says the *Engineer*, by Mr. J. T. Smith, of Rhine Hill, Strat-



WROUGHT IRON CHIMNEY AT DARWEN.

ford-on-Avon, and the Pearson & Knowles Coal and Iron Company, to supersede brick stacks of the ordinary description, which were used for carrying off the gases from the blast furnaces of the Darwen and Mostyn Iron Company. This chimney is 275 feet high from foundation to top, and the tallest iron structure of its kind in Great Britain. Shortly after erection, and before more than half the lining was in, it withstood without injury and in a perfectly satisfactory manner one of the severest gales experienced for many years.

The following are a few general particulars of this chimney. As stated above, the total height, including foundation, is 275 feet; height from bottom of base plate to top of chimney, 260 feet 6 inches; distance from bottom to top of cone, 28 feet; distance from top of cone to top of chimney, 232 feet 6 inches; taper from bottom to top of cone, 10 feet 6 inches; taper from top of cone to top of chimney, 6 feet; number of tiers of plates, 66; total number of plates in chimney, 308; diameter of base plate, 27 feet 6 inches; base plate made in six segments; number of rivets used in construction, 17,000; twelve foundation bolts, 16 feet 3 inches long, by 2½ inches diameter, with swelled and screwed ends; total weight of iron work, 114 tons 7 cwt.; thickness of brick lining at bottom, 1 foot 6 inches; thickness of brick lining at top, 3 inches; time occupied in erection of iron work, 11 weeks; total weight of chimney, including foundations and lining, about 1,100 tons; total weight of a brick chimney same height, over 3,000 tons.

This system of construction, for chimneys about the same height, has many advantages. These should receive the careful consideration undoubtedly due to them by all interested in the subject. In the first place, there is a saving in the cost as compared with a chimney of similar height built in any other manner. The time occupied in erection is also much shorter, and, under certain circumstances, this must be a considerable advantage, especially as the work is not affected or stopped by frost. It is well known that the uncertain and imperfect nature of ground upon which a chimney may have to be constructed is often a source of grave anxiety to owners of chimneys, architects and builders. If, therefore, a reduction from the ordinary weight can be effected by building with iron, without, at the same time, in any way impairing the margin of safety, this should be a recommendation to the system. It is proved that iron chimneys are of much less weight. There is also the satisfaction of knowing that chimneys built in this way are necessarily free from the liability to sudden collapse, and to cause accident by material falling from them, due in brick chimneys to the cracking and displacement of the external surface, caused by the high temperature of the gases or defective workmanship. An additional advantage of this form of construction, to the Darwen and Mostyn Iron Company, is the freedom from damage to their chimney by excessive heat, produced in the manufacture of ferro-manganese.

In America there are many wrought iron chimneys erected in connection with different works. The Pennsylvania Steel Company have no less than eight such chimneys, varying in height from 110 feet to 170 feet. The Cleveland Rolling Mill Company, Ohio, has one 213 feet high. In France and Russia iron chimneys are also used. MM. Schneider & Company have one at Creusot, France, 280 feet high, and Mr. Bhekoldin, of Kineshnia, Russia, has one at his paper mills 170 feet high. There are also several smaller chimneys of the same kind in this country, in addition to that at Darwen already described. The Pearson & Knowles Coal and Iron Company, Limited, has seven, varying in height from 50 feet to 87 feet. The Acklam Iron Company, Limited, has two, 165 feet high, at the Acklam iron works, near Middlesbrough. There is one at Messrs. B. Heath & Sons works, Stoke-on-Trent, and also at the Nine Elms cement works, and several at different iron works in the Middlesbrough district.

The tallest brick chimney in the United Kingdom is at Glasgow. It is 468 feet from bottom of foundation to top of coping; diameter outside at ground line, 32 feet; at top, 13 feet 4 inches; thickness of brick work at bottom, 5 feet 7 inches; at top, 1 foot 2 inches. No piles were used in the foundation, the blue clay upon which the chimney was built proving satisfactory. One million and a half bricks were used in its construction, and the time occupied about three years. Total weight, about 8,000 tons; total cost, about £8,000. The next tallest chimney, also at Glasgow, is 455 feet 6 inches from bottom of foundation to top of coping; outside diameter at foundation, 50 feet; at ground line, 40 feet; at top, 13 feet 6 inches.

A short account of the successful demolition of a tall brick chimney may be interesting. Some years ago the tall circular brick chimney at Messrs. Muspratt's chemical works, Warrington, 406 feet high, 46 feet diameter at base, 17 feet diameter at top, was destroyed by gunpowder. The works having been moved to another locality, the chimney was not required. Mr. Stephen Court, engineer and architect to the St. Helens Canal and Railway Company, superintended these operations. A number of holes were dug

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round the base, and fourteen charges of gunpowder inserted. These charges were fired at 2:30 p. m. Nine charges exploded without any apparent damage to the stability of the chimney, but the report of the tenth had no sooner been heard than the chimney was seen to be rent from top to bottom, and the huge mass disintegrated from the base upward. The chimney fell very nearly within the circumference of its own base. No accident occurred.

We understand that a steel chimney, 350 feet high, is now being constructed at the Chicago Exhibition.

Sugar Crystals.

A correspondent asks the editor of the *Louisiana Planter:* "Does a grain of sugar contain any impurity in itself? It appears to me that sugar in crystallizing would repel all foreign matters." To which the editor replies as follows:

"A grain of sugar is rather an indefinite term. Sugar may crystallize in large crystals or small, and seemingly large crystals of sugar are frequently an agglomeration of smaller crystals, in the interstices between which impurities may be retained. Further, a thin film of impurity, ordinarily containing colored matter, surrounds each crystal of ordinary sugar, and if it were possible to remove this coloring matter, such crystals would be transparent. The largest single crystals of sugar known are made by the rock candy process, and such crystals are comparatively transparent.

We may, therefore, say that our correspondent is correct in believing that sugar in crystallizing would repel all foreign matter, but that practically sugar does not crystallize into individual crystals, but into agglomerations of crystals, which may, and ordinarily do, engage considerable foreign matter with them."

THE BOHEMIAN TWINS.

The twin sisters, Rosa and Josepha, who were lately exhibited in Vienna, excited the interest, not only of scientists, but also of the lay public, on account of the union of their bodies. They were born in Skreychow, Bohemia, and are now fifteen years old. Their parents, simple people named Blazel, gave them up to the French impresario Forbé, who first brought them before the public in Paris, at the "Theatre Imperial de la Gaité," and is now taking them on a tour through Europe.

Rosa and Josepha, of whom we publish an engraving, are not well grown for their age, but are delicate and frail. Their complexions and hair are dark, and their faces, which are very much alike, show no traces of their nationality. As will be seen from the cut, the first impression is that they are two perfectly formed individuals with a connection at the hips, but an investigation proves that this is not the case; for, although the upper parts of their bodies are separate, the backbones grow together in the region of the coccyx, and there is only one pelvis; strangely enough, however, there are four legs instead of two. Therefore, we have not two complete beings that have grown together, but two half female bodies, so to speak, that are normally developed only as far as the hips. Under the circumstances a separation by means of a surgical operation was impossible. When one half of this unfortunate double creature dies, the other sister must soon meet the same fate.—*Illustrirte Zeitung.*

THE BOHEMIAN TWINS.

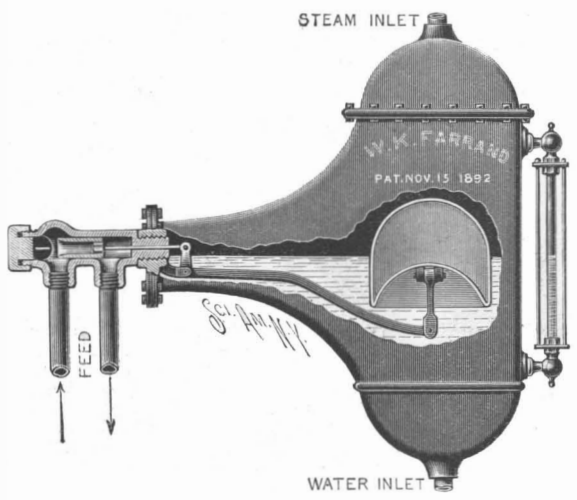
Prize for Red Cross Improvements.

The King and Queen of Italy, as is well known, have been interested for many years in all improvements for the care of the sick and wounded. They have now offered a prize of 10,000 lire, or $2,500, for the best apparatus for carrying the wounded and sick to places where they may be cared for. The offer is a result of the recent meeting of the Society of the Red Cross in Rome. Inventors of all countries are invited to enter the competition for the prize. Models, not less than one-fourth the size of the originals, must be sent to Rome, in care of Signor L. delli Sanaglia, not later than June 30, 1893. The models must be accompanied by detailed descriptions in French or Italian, or translations into one of those tongues. An exhibition of the apparatuses will be held in Rome from August 11 to September 15. A jury, consisting of fourteen representatives of the countries which took part in the congress of the Red Cross, will award the prize.

EXPERIENCE in electrically welding shows the metal is strengthened at the point of welding.

AN IMPROVED AUTOMATIC BOILER FEED.

The feed regulating valve shown in the illustration, and which has been patented by Mr. William K. Farrand, is positive in operation, not liable to get out of repair, and operates automatically to preserve the exact correct height of water in the boiler. The water column is for convenience made in two parts, a nipple at the top connecting with the steam space of the boiler and one at the bottom with the water space, so that the water will always be at the same height in the column as in the boiler, and will be thus indicated on the water gauge. In an extension at one side of the



FARRAND'S FEED REGULATING VALVE.

water column screws the stem of a valve casing, in which is a water inlet and a water outlet, as shown by the arrows, there being at the outer end of the casing a removable cap, on the inner surface of which is secured a semispherical seat, preferably of rubber. Opposite this seat is a cylindrical valve, fitting snugly in the casing and adapted to move horizontally, the valve being beveled on its inner edge to fit smoothly and tightly upon the seat. The valve is open at both ends, and its stem extends through the stem of the casing to a pivotal connection with one arm of a bell crank lever fulcrumed at its elbow on a suitable support, the other long bent arm of the lever having a float secured to its free end. The float has a chamber in its bottom, designed to create an excessive suction, so that, should the valve stick as the water in the column dropped, the suction created by reason of the chamber would cause the float to be pulled down with force to start the valve from its seat. This valve may be used for regulating the supply of water in receptacles other than boilers.

Further information relative to this improvement may be obtained by addressing Mrs. Elizabeth Riley, No. 452 Classon Avenue, Brooklyn, N. Y.

The Old Saugus Iron Works.

An old fashioned iron pot, said to be the first iron casting made in America, in 1642, was lately presented to the city of Lynn, Mass., on which occasion C. J. H. Woodbury, of Boston, delivered an address on the Saugus Iron Works, where the casting was made.

The Saugus Iron Works were an important factor in the inception and early development of American industries.

The site of the works was situated at the head of navigation, by the ford in the highway from Boston to Salem, at a water power, and near to the bog iron ore deposits, whose exact location is unknown, save that they were in Adam Hawkes' meadows. The whole iron works tract probably covered 3,000 acres.

The works contained a blast furnace, in which bog iron ore was reduced by means of charcoal, using as a flux lime, which in the earliest days of the works was obtained from the oyster shells which then abounded on the coast of Massachusetts Bay. Cannon were also melted at this foundry, far in advance of the time when swords were to be beaten into plowshares or spears into pruning hooks.

The iron from the blast furnace was run into straight trenches in the sand, and thereby cast into long triangular bars called "sowe iron," which were converted into wrought iron and steel. Castings were made directly from the metal flowing from the blast furnace into a pool, whence it was dipped by crucibles and poured into the moulds. The cupola furnace was not invented until 1790.

The wrought iron and steel were made in a blomary, which may be described as a charcoal fire four feet thick in a blacksmith's forge. The end of a bar of sow iron was plunged into the fire, and in time a pasty mass of wrought iron would settle to the bottom. Other portions of the bar would be converted into steel when the process stopped at the intermediary stage between cast and wrought iron. This process of steel making is still used throughout the Oriental nations, and also in the mountainous region south of the Ohio River.

The iron works also included a machine shop, in which the first fire engines made in America were built for the town of Boston, in accordance with a vote of the town meeting, March 1, 1654.

When Governor John Endicott began the oak tree and pine tree coinage, in 1652, the dies were made by Joseph Jenks at the Saugus Iron Works.

It is stated by Judge James R. Newhall that the designs were made by Elizabeth, the wife of Joseph Jenks, the master mechanic.

Joseph Jenks also invented a sawmill, which received a patent for fourteen years from the General Court, on June 10, 1646, being the first patent granted in America, and also a water engine for mills, which was undoubtedly a form of water wheel, and not the hydraulic engine which that term would now signify.

He also invented the modern American scythe, long and narrow, and stiffened by a ridge along the back, a marked improvement "for the more speedie cutting of grasse" over the broad, short bushwack scythe made from a thin plate of steel, and richly deserved the patent for seven years which was granted by the General Court, May 23, 1655.

In 1667 he petitioned the General Court relative to a wire manufactory, and May 15, 1672, his petition for authority to coin money was refused.

The works are not known to have been in operation after 1688, when the tract had diminished to 600 acres and passed into individual ownership.

The Stimson Institute, New York.

The institute was founded four years ago to provide American labor with the facilities for acquiring skill and taste in design. In four years over four hundred students have been educated.

At present the teaching force consists of twelve specialists, in charge of Mr. Stimson, and a numerous and enthusiastic body of pupils drawn from all parts of the United States is in attendance. The range of instruction embraces architecture, sculpture, painting, and drawing in all their forms, book illustration and covering, wood carving, wall paper designing and mural decoration; silk, calico, cretonne, and carpet designing; ceramic, tile, and porcelain work; meta and jewelry designing, with other ornamental domestic arts where now we are obliged to employ foreign skill if we require first-class work. What is immediately needed to put this institute on a sure foundation is practical support by men who appreciate what is being done abroad and what must be done at home in the line of the technical education of the artisan.

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NATURAL RESOURCES OF VIRGINIA AND WEST VIRGINIA.

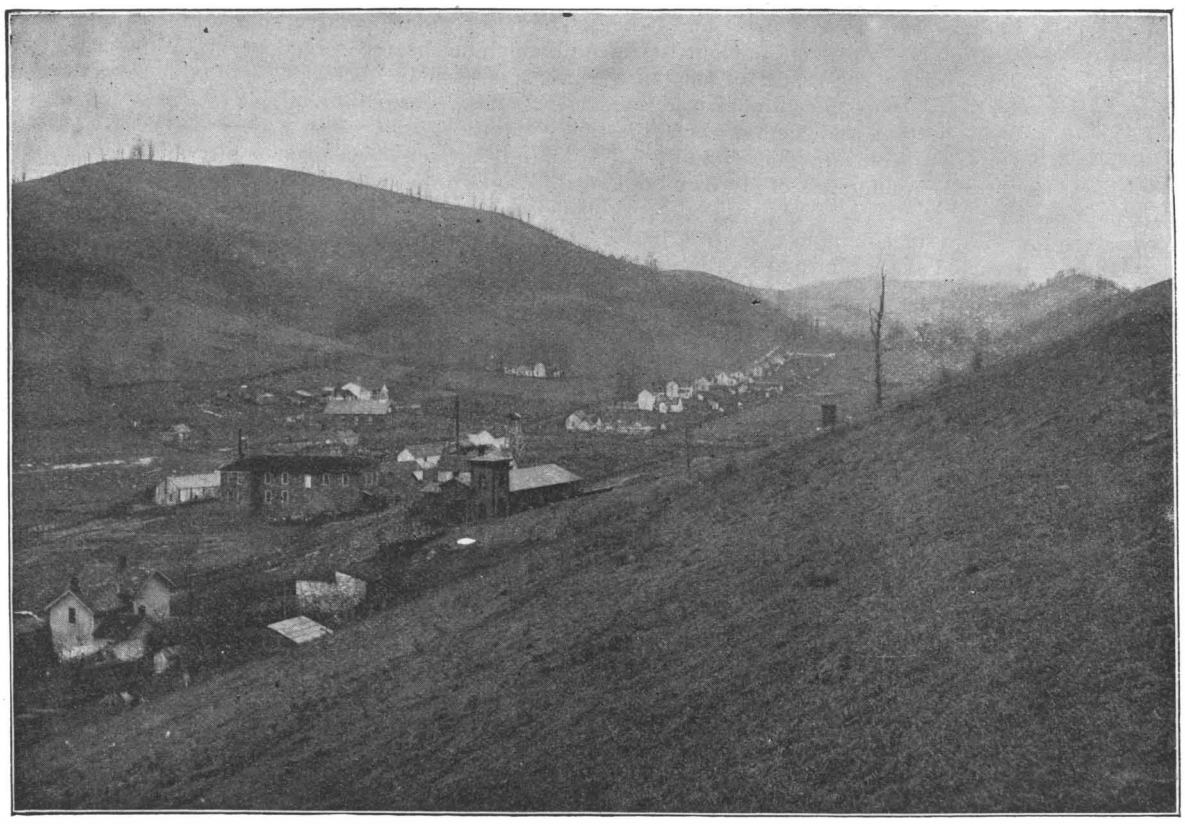
(*Continued from first page.*)

plain view of the railroad. About 10,000 tons of fine salt are shipped annually, and it is proposed to enlarge the works and double the production at an early date. The brine from these salt wells is stronger in saline matter than from any other salt well in this country.

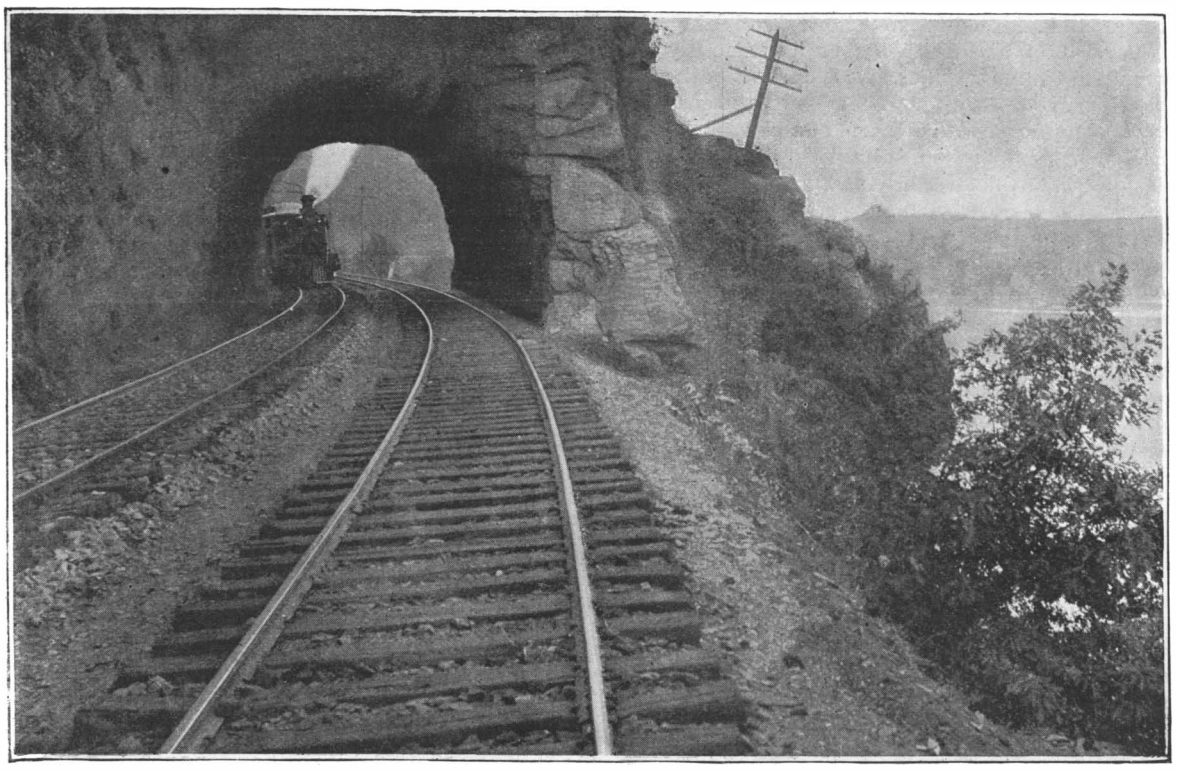
The comparative table of population of some of the more important of these towns during the past ten years which we publish in this issue will show how marked has been the progress made, Roanoke, Virginia, and Huntington, West Virginia, showing the largest percentage of gain. The former is one of the solid cities of the new South, and while the location of the shops of the Norfolk and Western system gave it its start, the many large industrial concerns that have since located at this point give evidence of the solid growth of the place. We give a view of Crystal Spring Park, which is located in Roanoke. This is delightfully situated, and derives its name from the famous spring from which the city receives its water supply, and it gushes in apparently inexhaustible supply from the limestone mountain near the city.

Both Virginia and West Virginia are rich in minerals of all kinds, particularly in coal and iron, and the mines in the Pocahontas region of West Virginia, which produce a superior kind of steam coal, are noted, and it has become necessary to double track the railroad to Lambert's Point, Norfolk, to bring this coal to tide water.

The foreign and coastwise commerce of these States has grown very rapidly, and on one page we show the three great shipping points for the three trunkline roads that reach the Atlantic. Newport News, the outlet for the Chesapeake and Ohio, has increased very rapidly, as it was not incorporated in 1880. Here is located the large shipbuilding establishment, which is one of the most complete in this country, and from this port it is proposed to run a new steamship line, consisting of six first-class vessels, to Liverpool.



SALTVILLE, VA.—NORFOLK AND WESTERN RAILROAD.



ABOVE HARPER'S FERRY—BALTIMORE AND OHIO RAILROAD.

West Point is the outlet for the Richmond and Danville Railroad and is one of the largest cotton shipping ports in this section, standing second to Norfolk. The population of this place, as will be seen from the table published elsewhere, increased from 557 in 1880 to 2,018 in 1890.

Lambert's Point, which is the outlet of the Norfolk and Western Railroad, has grown very rapidly, and during the year 1891 handled almost 1,700,000 tons of freight, or about 30 per cent of all carried by this road. Virginia and West Virginia are fortunate in having railroads within their borders with such liberal ideas, and to the Baltimore and Ohio, Chesapeake and Ohio, Richmond and Danville, and Norfolk and Western, is due the marked advance made by these States and the rapid development of the many industrial towns which have so recently come into existence.

POPULATION OF INDUSTRIAL TOWNS AND CITIES IN VIRGINIA AND WEST VIRGINIA FOR 1880 AND 1890.

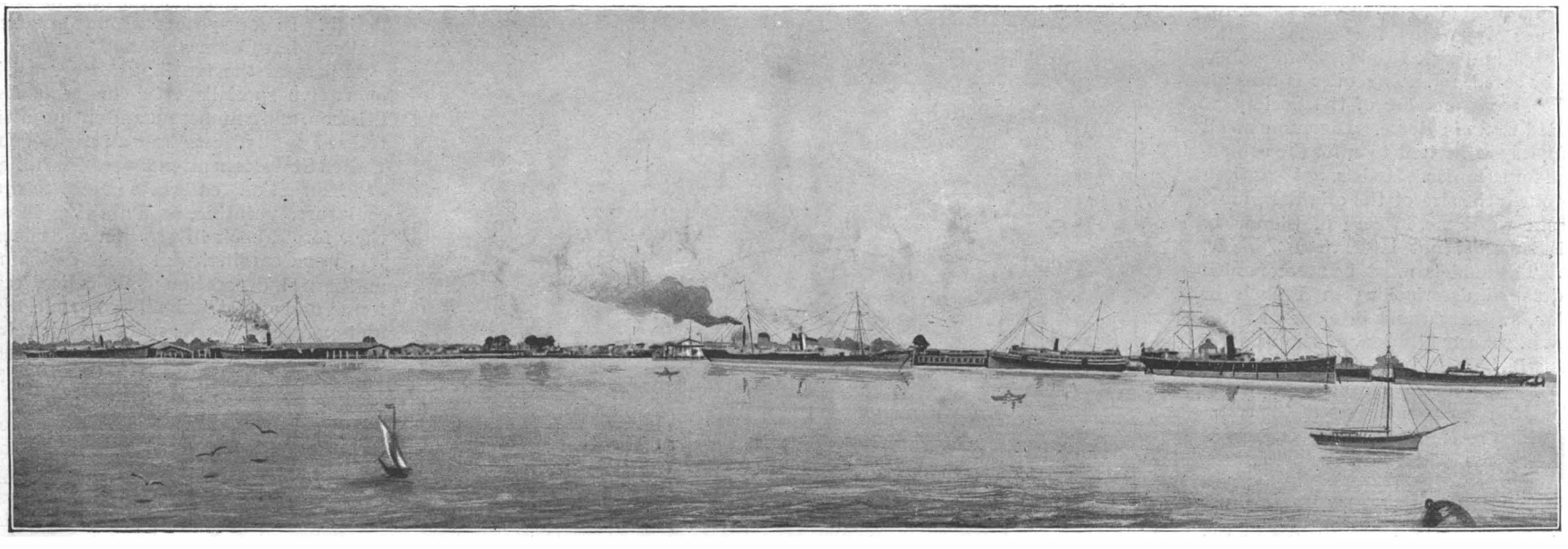
Virginia.

Cities and Towns.	Population. 1890.	Population. 1880.	Gain in Percentage.
Richmond	81,388	63,600	27·97
Norfolk	34,871	21,966	58·75
Lynchburg	19,709	15,959	23·50
Roanoke	16,159	669	2,315·40
Danville	10,305	7,256	36·93
Manchester	9,246	5,729	61·39
Charlottesville	5,591	2,676	108·93
Newport News	4,449	.....	.....
Berkley	3,899	.....	.....
North Danville	3,799	1,200	266·58
Suffolk	3,354	1,963	70·86
Salem	3,279	1,759	86·41
Pocahontas	2,953	.....	.....
Bristol	2,902	1,562	85·79
Luray	2,809	632	344·46
Wythevilie	2,570	1,885	36·34
Pulaski	2,112	.....	.....
Radford	2,060	.....	.....
West Point	2,018	557	262·30
Total for State	1,655,980	1,512,565	9·48

West Virginia.

Cities and Towns.	Population. 1890.	Population. 1880.	Gain in Percentage.
Wheeling	34,522	30,737	12·31
Huntington	10,108	3,174	218·46
Parkersburg	8,408	6,582	27·74
Charleston	6,742	4,192	60·83
Benwood	2,934	.....	.....
Moundsville	2,688	1,774	51·52
Hinton	2,570	879	192·38
New Cumberlandtown	2,305	1,218	89·24
Total for State	762,794	618,457	23·34

The shipments of coal and coke transported over the Norfolk and Western Railroad since the completion



WEST POINT, VA.—SHIPPING PIERS OF RICHMOND AND DANVILLE RAILROAD.

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of their New River Division to the Pocahontas Flat. Top coal fields have been as follows:

	Coal. Net Tons.	Coke. Net Tons.
1882	4.735	....
1883	82,043	23,762
1884	215,818	56,360
1885	603,416	48,571
1886	870,614	59,021
1887	1,157,423	151,171
1888	1,567,983	202,808
1889	1,813,745	310,504
1890	2,044,567	433,319
1891	2,341,226	466,016
1892 partly estimated	2,950,000	550,000

The shipments at the present time are far behind the orders, owing to scarcity of transportation facilities.

West Virginia has more square miles of coal than Great Britain, Germany and France combined, and though her development career has just begun, she stands fifth in point of coal production in the United States. A table of the output for the years 1888, 1889 and 1890 is given herewith:

District.	Tons 1888.	Tons 1889.	Tons 1890.
From Elk Garden	564,397	576,047	774,904
From Kanawha, per C. & O.	1,000,000	1,700,000	2,000,000
From Kanawha, by water.	1,350,000	1,200,000	1,250,000
From line of B. & O. road	650,000	750,000	900,000
From other sources	500,000	500,000	500,000

Making a total product for years named:

1888	4,700,000 tons.
1889	4,726,000 tons.
1890	5,424,904 tons.

We also publish a view of Danville on the Dan River, on Richmond and Danville Railroad. This place is growing rapidly and many factories are being located at this point.

Radford, Va., on the line of the Norfolk and Western Railroad, is also illustrated. It is delightfully situated on New River, as shown in the cut, and is growing very rapidly, having more than doubled in population since the census of 1890 was taken.

The view of the Shenandoah Valley which we give was taken from the Baltimore and Ohio Railroad, and is the best farming region of these States.

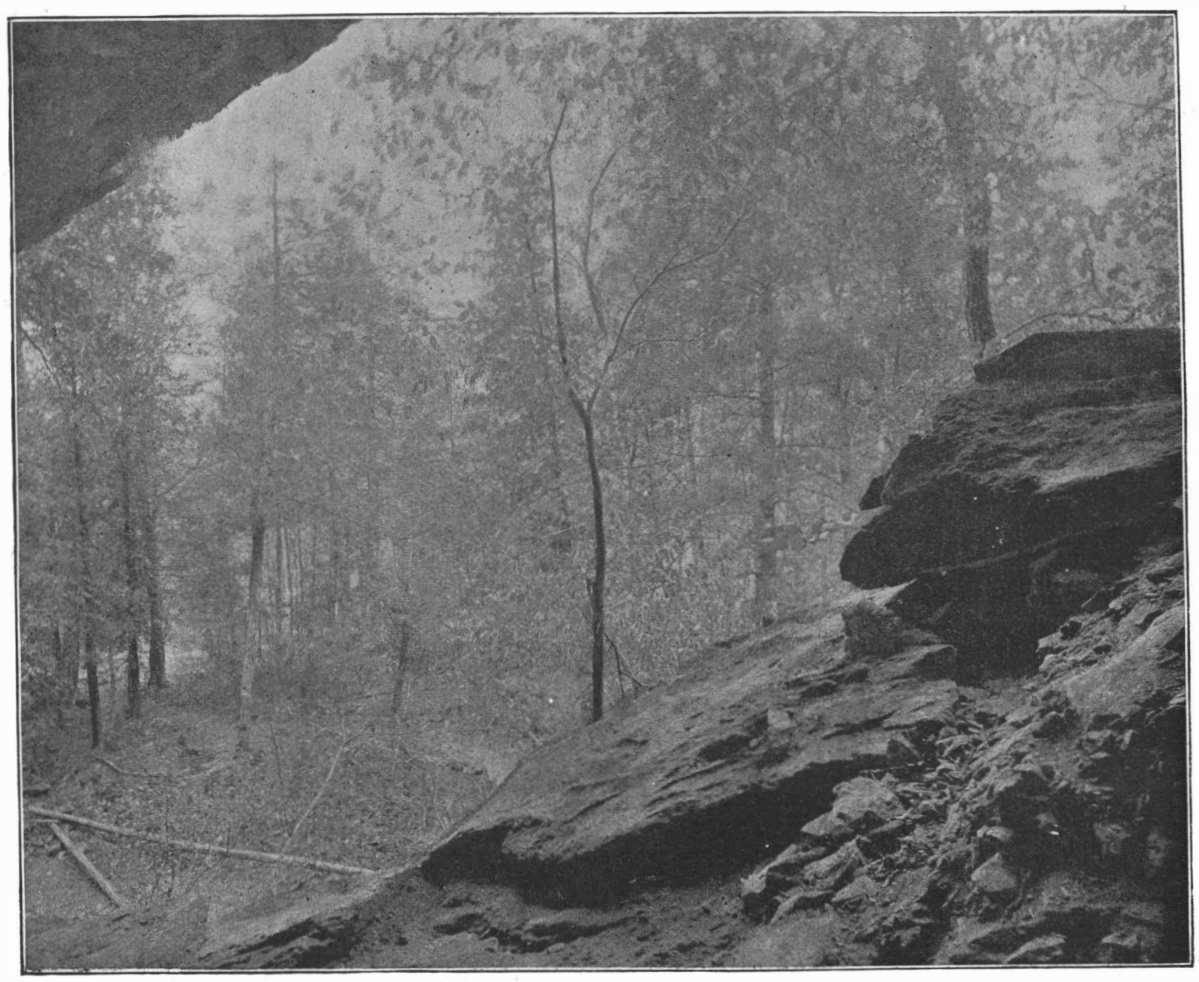
At the Bertha Zinc Works, Pulaski, Va., zinc of the best quality is made, and it is used at the United States mint in Philadelphia, and is there regarded as the standard.

The only views we have given in the vicinity of Norfolk are of Newport News and Lambert's Point, which are the outlets of the trunk lines that bring coal and iron to tide water.

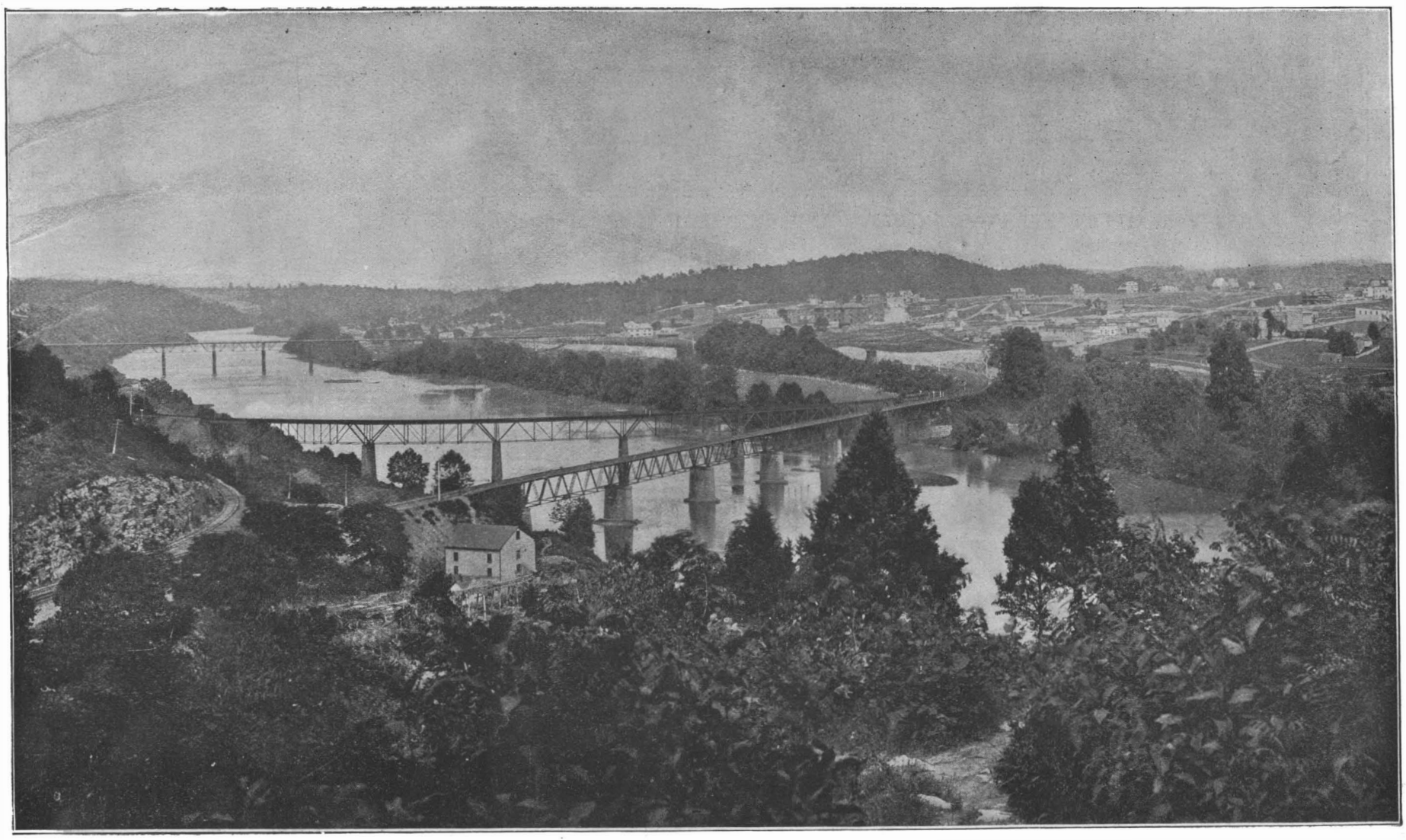
We are unable to give the production of these States for 1890, as the Census Office has not yet completed the tables, but enough is known to show that they will take their place among the great manufacturing sections of the country, and for beautiful and diversified scenery they stand to-day unrivaled.

Brick Pavements.

There were put down last fall nine and three-quarter miles of vitrified brick pavements in Evansville, Ind. The brick used was from New Cumberland, W. Va., and the foundation was of broken stone, with only one layer of brick. Brick pavements have been used for years in Evansville, and also Decatur, Ill., and have given the greatest satisfaction. In Decatur one pavement has been down for several years, and no repairs have been necessary yet, and the general assumption is that the pavement will remain in good condition for at least twenty years yet. There can be no doubt that the coming pavement is to be constructed of vitrified brick. It is the nearest approach to the ideal pavement for city streets. It is not so dusty as asphalt, which, in this respect, is highly objectionable. Brick pavement, too, is practically as smooth as asphalt, and will retain an even surface, which no other pavement does so satisfactorily as brick. It is easily repaired, and when it is necessary to take it up for the purpose of tapping or repairing sewers, water or gas pipes, or for any other purpose, the work can be done by ordinary workmen, while a limited number only of skilled and high-priced workmen can repair asphalt pavement, and only, moreover, in certain kinds of weather. It has been truly said that "the best pavement is the one most easily repaired." The necessary repairs to water and gas pipes alone should convince every one of this fact. Cities can construct and maintain a vitrified brick pavement at less cost than any other kind of material. The life of this pavement has been put at twelve years, but twenty-five years represents more truly its average lasting capacity.—*Clay Record.*



SALTPETER CAVE, NEAR NATURAL BRIDGE, VA.



RADFORD, VA., ON NORFOLK AND WESTERN RAILROAD.

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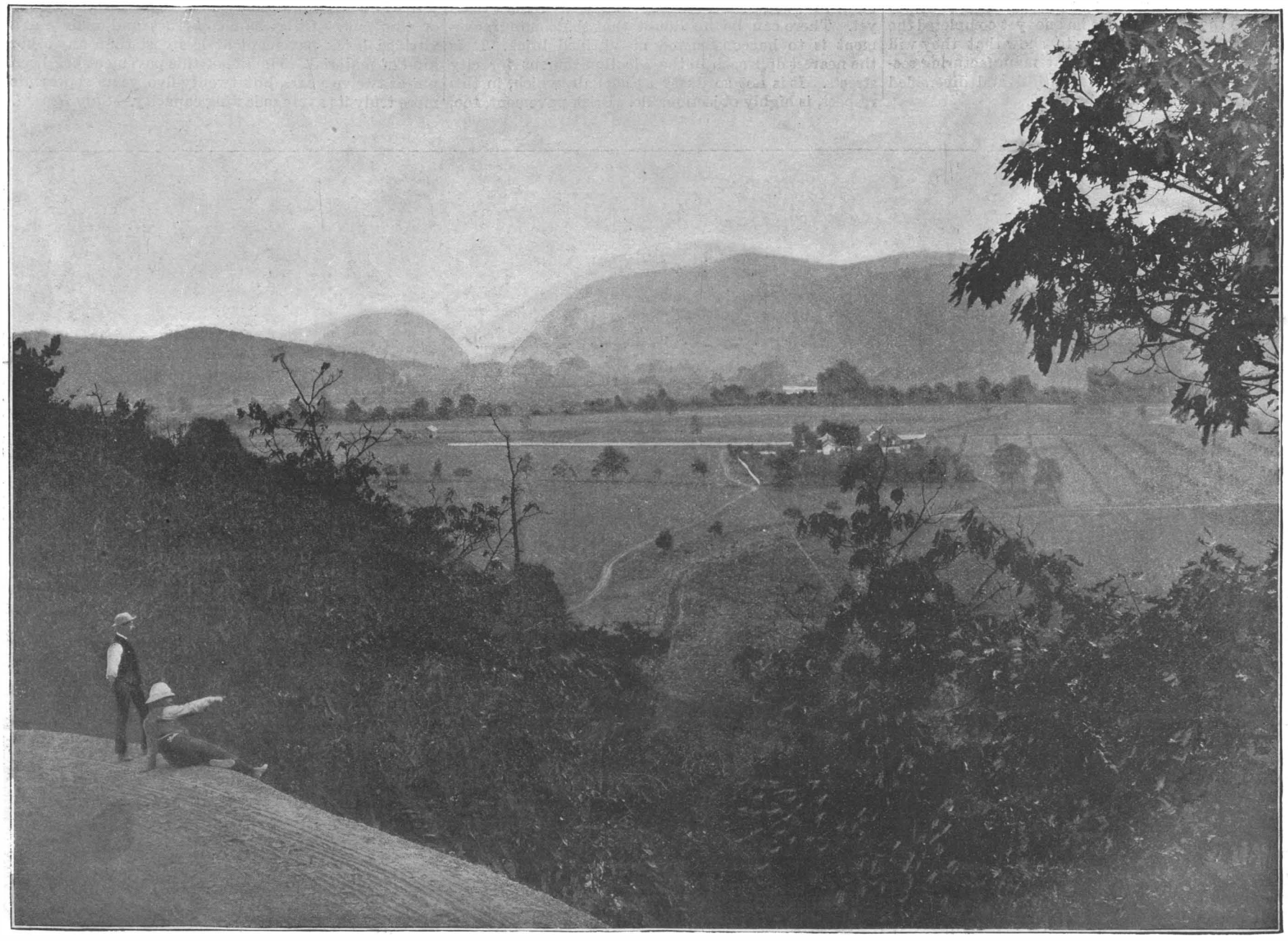
The Atlantic Steamers.

The development of the machinery of Atlantic liners was the subject which Mr. Arthur J. Maginnis, M.I.N.A., the well known engineer and surveyor, Liverpool, had for a most interesting and valuable paper which he read before the Liverpool Engineering Society, on the 9th of November. The *Steamship* gives a summary, from which we derive the following:

Mr. Maginnis pointed out the gradual development in the horse power, displacement, and speed of various representative vessels, from the Savannah in 1819 to the coming Cunarder Campania, which was estimated to represent 20,000 tons displacement propelled 22 knots with 1·5 indicated horse power to the displacement ton. Commencing with side lever engines for paddlewheel vessels, the various types of machinery of this class were described, followed by descriptions of screw-propelling machinery, in the various forms of beam, steeple, oscillating, and other geared screw engines, also various types of direct-acting engines, and the evolution to compound and triple-expansion engines. He also pointed out the gradual saving which had been effected in the weight of the engines per horse power, as well as the saving in the consumption of fuel. As showing the difference in the weight of the machinery nowadays as compared with fifty years ago, the author instanced the striking fact that if the 30,000 horse power engines of the Campania were to be built the weights possible in 1840, the machinery alone would nearly equal the whole of the displacement of the vessel, as it would reach 18,750 tons, and would require a consumption of something like 1,500 tons per twenty-four hours.

But while he was able to point out the great improvements that had been made on the marine engine, the author was unable to allude to any great change or advancement in the efficiency of the boiler. That the marine boiler is at a standstill, as it were, in the matter of efficiency, has long been matter for surprise, and it is to be hoped that it may now receive a little more attention than in the past. The pressing need of improvement was commented upon to reduce the weight and space occupied on board ship, and it was noticed

ROANOKE, VA.—VIEW IN CRYSTAL SPRING PARK.



VIEW OF SHENANDOAH VALLEY, VIRGINIA, FROM BALTIMORE AND OHIO RAILROAD.

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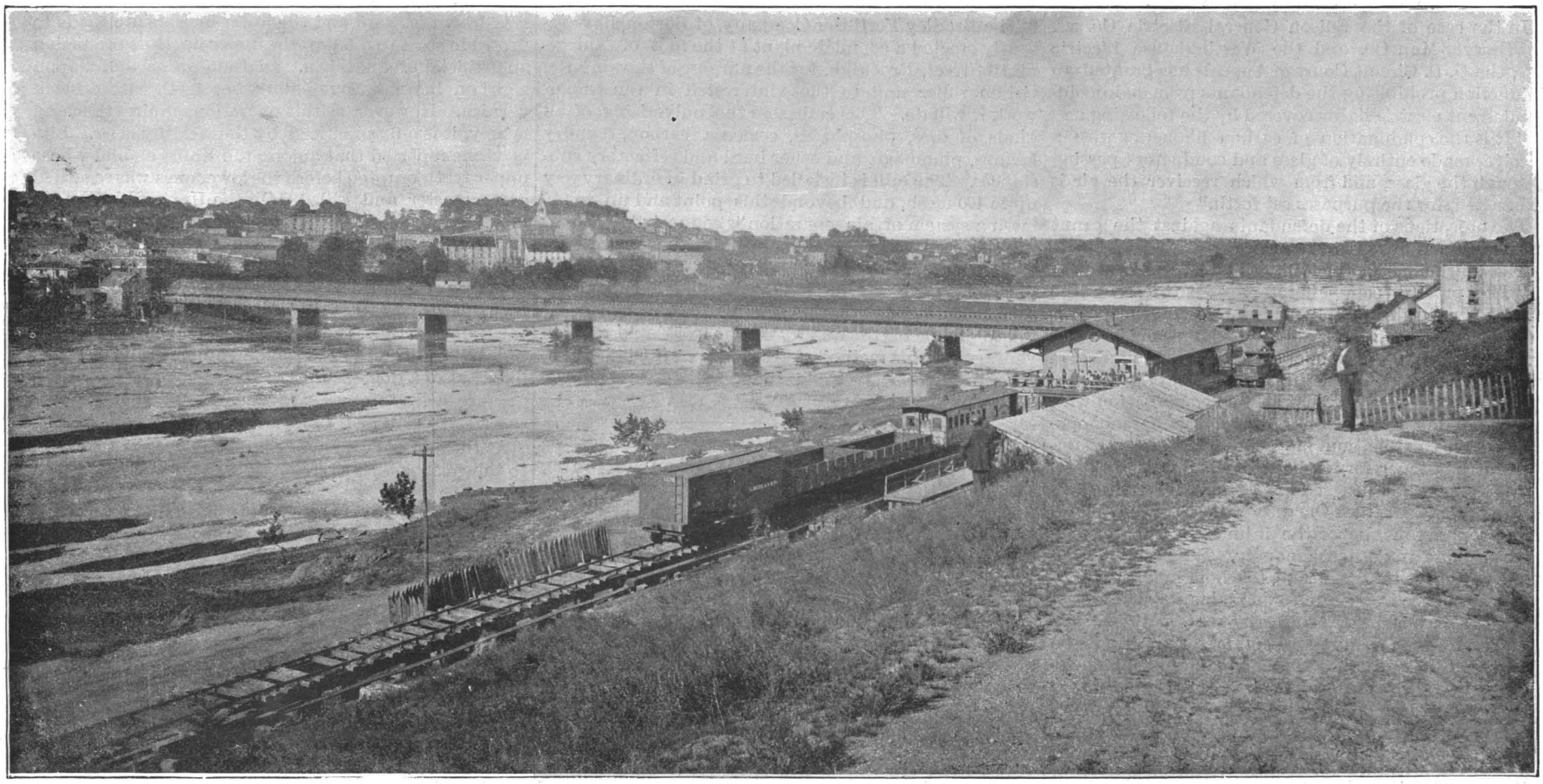
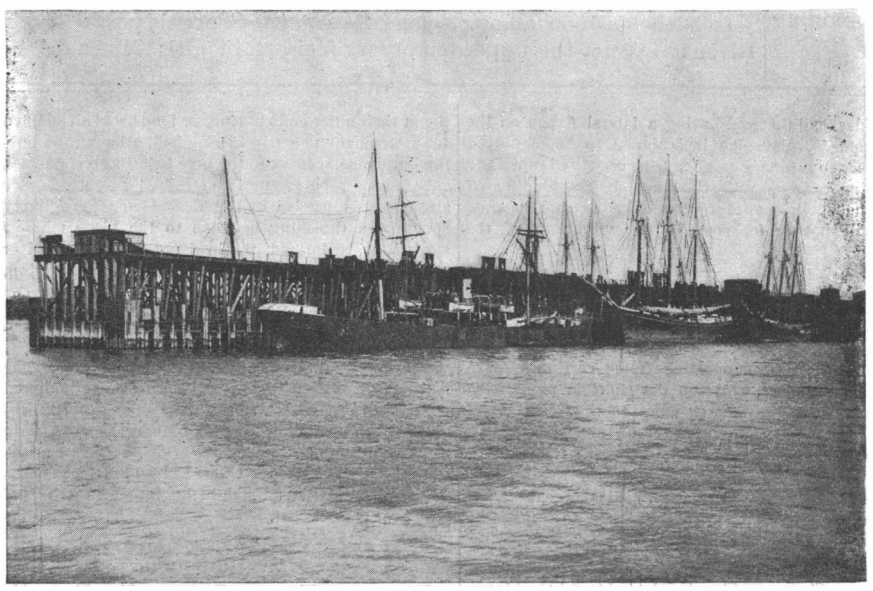


DAN RIVER BRIDGE DANVILLE VA., ON RICHMOND AND DANVILLE RAILROAD.

that of all the various forms used, marine engineers looked to the locomotive type as coming nearest to meet their requirements in the future. With the improvements in the feed and general working of boilers which have taken place, the author considers that the successful working of this class of boiler is now within measurable distance; and he says it now "only remains for an enterprising Atlantic line and engineering firm to take the step and test it under the favorable conditions now existing." That the step is well worth considering might be seen from the comparison drawn by Mr. F. C. Marshall, in a paper read before the Institution of Naval Architects, in 1888, which, among other war vessels, gave two of exactly equal indicated horse power, one with modified locomotive and the other with naval boilers, the weights with water being in the former 49 pounds per indicated horse power and 74 pounds in the latter, so that the locomotive boiler effects a saving in weight of 33 per cent. This, in the weight given for the new Campania—viz., 1,200 tons—would mean a gain of 400 tons in earning weight.

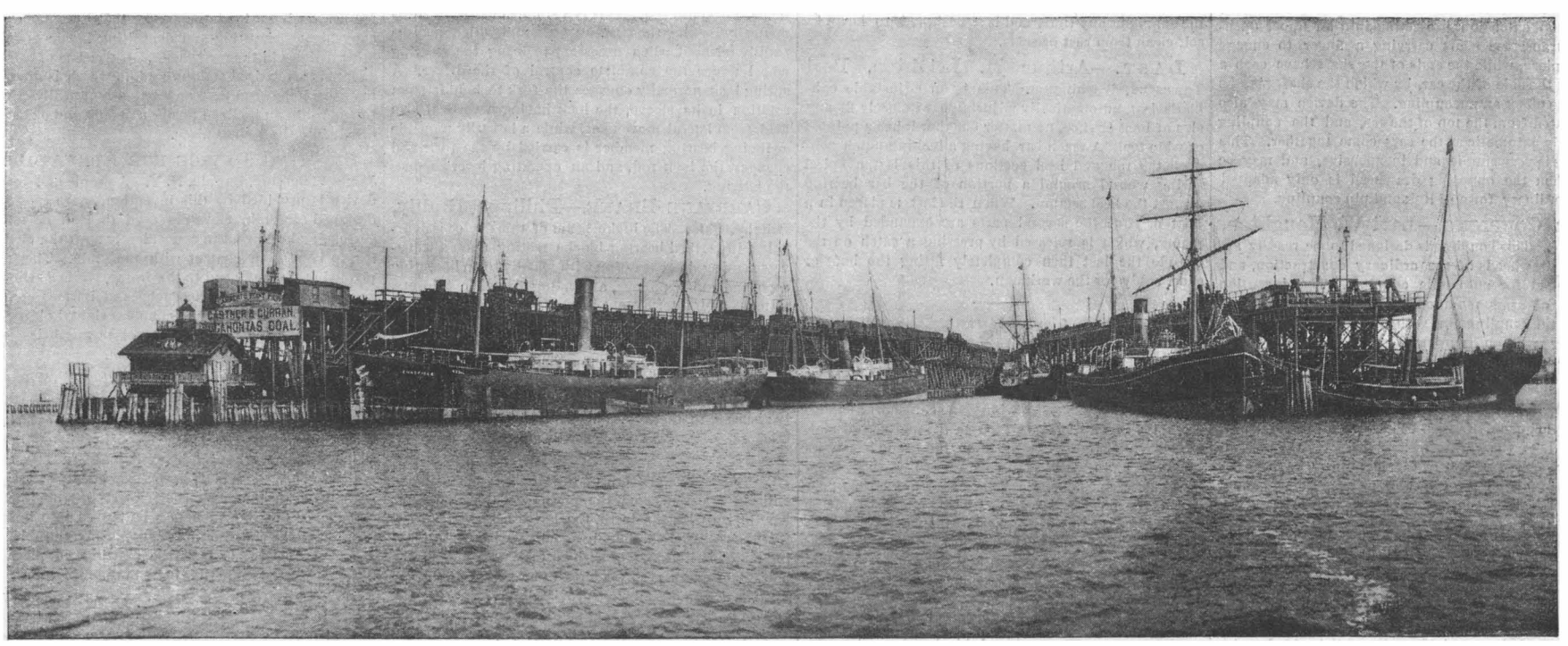
There is a very pleasing feature in connection with the Atlantic traffic which Mr. Maginnis takes special note of toward the end of his paper, and that is the great immunity from breakdown of machinery which at present characterizes the vessels engaged on the Atlantic ferry. Although the voyage "is admittedly the wildest and most trying in the world," the author says that, taking the year ending 1st October last, out of a total of nearly 4,000 departures from port, or an average of 74 per week, he had only been able to trace seven breakdowns of machinery which caused serious delay, and only three total disablements. That there should be such immunity from breakdown where there is such an enormous traffic is nothing short of marvelous. Such a gratifying condition of things, even in this age of unique achievements, is worthy of note, and, although redounding to the credit of both builders and owners in proving that the best designs, materials, and workmanship have been utilized, it would be idle to deny that were it not for the care and attention taken and given by the engineers in charge at sea—the men who bear the heat and brunt of the day, from the chief downward—the result would not be so satisfactory nor the advances which have been made become practicable.



NEWPORT NEWS VA.—SHIPPING WHARVES CHESAPEAKE AND OHIO RAILROAD.

Lanoline.

Wool fat contains wax-like substances, which are produced by the splitting up of the cholesterin, isocholesterin, and higher alcohols. This wax detracts from the medicinal fitness of wool fat, and Dr. Benno Jaffe and Dr. Ludwig Darmstadter have devised a process for effecting an improvement. This process consists in dissolving the wool fat in benzol, toluol, ether, chloroform, or other suitable solvent, several of which are named, and adding to the solution ethyl or methyl alcohol, which has the effect of throwing out the wool wax proportionately to the amount added. An alternative method is to dissolve the crude fat at its melting point in fusel oil, and it is found, on cooling, that the wool wax crystallizes out. The result in either case is that the purified fat is much improved, especially in consistency, and it makes "an excellent lanoline" on further treatment by the applicants' well-known process.



LAMBERT'S POINT NORFOLK, VA.—SHIPPING WHARVES OF NORFOLK AND WESTERN RAILROAD.

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The Great Electric Light Suit.

In the case of the Edison General Electric Co. vs. the Sawyer-Man Co. and the Westinghouse Electric Co., the U. S. Circuit Court of Appeals has granted an injunction prohibiting the defendants from making incandescent electric lights covered by the following:

"It is the combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth."

The objections of the defendants against the grant of the injunction were overruled.

The court, among other things, holds as follows:

"The present complainants are entitled by the patent laws to a monopoly for the term of the patent of the manufacture and sale of the lamps made under it. The right to this monopoly is the very foundation of the patent system. They do not lose that right merely because they may have joined in a combination with others holding other patents securing similar monopolies, which combination may, when judicially examined in the proper forum, be held to be unlawful.

"We do not feel justified in assuming upon the facts in the present suit that the use which the complainants propose to make of the injunction will be such as to promote any other monopoly. When it shall be made to appear that some one, to whom in fairness and good conscience these same complainants should sell their lamps, has been arbitrarily refused them, save upon oppressive and unreasonable terms, it will be time to consider whether the complainants should be allowed to continue in possession of the injunction.

"The injunction order appealed from should be modified so as to cover only lamps made in infringement of the second claim of the patent, the other claims not having been infringed according to the adjudication of the circuit court or of this court. It should also contain a provision reserving the right to the defendant to move hereafter for the vacation, suspension, or modification of the injunction upon proof of specific instances of refusal upon the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case to the owners of electric light plants which were installed before the rendition of the interlocutory decree of the circuit court sustaining the validity of the patent."

A Pulverizing Mill Plant in Brooklyn, N. Y.

The Bradley Fertilizer Company, of Boston, have recently erected a complete plant at the foot of Thirty-ninth Street, Brooklyn, for the purpose of showing the Griffin roller mill to those interested in the kind of work it will do. This embraces the pulverizing of all kinds of ores, phosphates, cements, carbon, foundry facings, plumbago, and other hard and refractory substances. The mill is installed to grind in ordinary way up to 100 mesh, and beyond this point and up to 250 mesh a system of air separation is connected, thus exhibiting a plant in actual operation with a range from 30 to 250 mesh, the product of the mill being delivered, finished, and of any mesh desired. The company express a willingness to grind samples for any one desiring to judge of the quality of the work and the advantages of this method of grinding. A full illustrated description of the Griffin roller mill appeared in the SCIENTIFIC AMERICAN of August 6, 1892.

Teeth Mutilation.

Dr. Magitot, of Paris, has published an interesting account of the mutilation of the teeth practiced by various savage tribes. One variety, which is chiefly met with on the coasts of Africa and the west coast of New Guinea, consists of the breaking of a portion of the incisor by means of a knife and a piece of wood, and is performed between the ages of twenty and twenty-five. The custom of extracting the two central incisors is found in both hemispheres. According to Zerate, it has been practiced in Peru from time immemorial, where it is inflicted on conquered tribes as a sign of slavery. In Africa it has been observed on the Congo, among the Hottentots and the Batoxas. The mutilation by filing has for its exclusive center the Malayan Archipelago, whence it has spread to the adjoining islands. It is a religious act, which is celebrated with great festivities at the age of puberty, but this only by the Mohammedans. The degree and character of this filing vary with the habits of the family or caste. The operation is performed by an expert, the *Tukang pangur* (filer), by means of a chisel, three bricks, two files, a small saw, and a pair of cutting nippers, the instruments being rubbed with arsenic and lemon juice before being used.

It is the fashion among some tribes on the Senegal River to extract the upper temporary incisors in girls when quite young and to manipulate the chin, so that it is drawn forward and the lower incisors are made to protrude so as to overlap the upper lip, thus producing an artificial prognathism. In Indo-China and Japan a girl on her marriage paints her teeth with a black varnish. However, as this operation requires time and money, it is only practiced by the wealthy class. Livingstone reported that among the Kafirs a child whose upper teeth erupted before the lower ones was regarded as a monster and killed. On the Upper Nile the negroes have their upper incisors extracted, in order to avoid being sold as slaves, because of the loss of value brought about by this mutilation. Among the Esquimaux, as described by the Abbe Peritat, in some regions there exists a custom of transversely cutting off the upper incisors, the object of this being, according to local tradition, to prevent the human chin looking like that of a dog.—*Lancet.*

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1893 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and the ARCHITECT'S AND BUILDER'S EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM GENERATOR.—Pierre A. Chatenet, Paris, France. This invention consists principally of a tubular casing closed at its ends and adapted to be heated, the casing being connected with a water charging device arranged to spray in the water in a finely divided state, while a tube open at its inner end is held in the casing to form a narrow annular space for the passage of the vapor, as it is heated by the wall of the casing, to the open inner end of the tube. The highly heated dried steam is passed from the inner tube to a steam-receiving vessel or to the engine.

SUBSTRUCTURE. — Samuel A. Oliver, Houston, Texas. This is an improvement in substructures designed to form supports for bridge piers and similar uses. Combined with the main structure is an inclosing caisson for its lower portion, a filling between the caisson and the main structure, and an inclined protecting plate for the top of the caisson. This substructure is designed to be conveniently erected and strong, amply protected against the action of water, and so built that the protective part of it may be easily renewed when necessary.

Railway Appliances.

CAR COUPLING. — Michael Werner, Allegheny, Pa. In this device the coupling hook is pivoted in the drawhead, and has a tail and lip projecting down through and into a base slot, and a top extension projecting into an upper opening, a transverse shaft carrying a finger to engage the tail piece, while the ends of the shaft have each a crank at the side of the car, by which the shaft may be rocked to effect an uncoupling. The device may also be operated from the top of the car, and the coupling is entirely automatic as the cars come together. This coupling is very simple and inexpensive, and may be used when the opposing drawhead is only adapted for the ordinary form of link and pin coupling.

CAR COUPLING.—Levi W. Houghton, Bath, Me. This coupling is designed to be readily applied to drawheads of the ordinary construction, and is arranged for automatic coupling. The invention consists of arms mounted to swing and adapted to support the coupling pin, with an arm for moving the swinging arms, and supported on the drawhead, to be engaged by a like arm on the opposite drawhead of the approaching car.

DRAW BAR ATTACHMENT.—Wilber B. Orton, Nickerson, Kansas. This invention relates to lugs to take the thrust or pull of the drawhead or drawbar spring when a car is pulling or backing up. The lug plate forming the spring pocket has integral vertical solid lugs for receiving the thrust of the spring followers, the lug plate also having other novel features of construction to make the lugs strengthen the draught timbers.

SPIKE.—Emma A. Streeter, New York City, N. Y., and Bradford W. Nichols, Herkimer, N, Y. This is an improved double-shanked spike, the shanks being straight and parallel sided, with its points similarly beveled on opposite front and rear sides, and the head having a lateral flange on the front side. This spike is designed to be employed wherever an ordinary spike may be used, and especially in laying railroad rails, the dual shanks holding so that the spike cannot be canted from side to side, and will not be loosened by the vibrations of the rails.

Mechanical.

POWER TRANSMITTING MECHANISM.—David C. Frazeur, New Market, N. J. A shaft journaled in a suitable supporting frame carries a drive wheel or fixed gear, while on the shaft is mounted a tubular shaft having one or more toothed wheels arranged to mesh with the teeth on and traverse the periphery of the drive wheel, an internally toothed rim being formed on the peripheral edges of the toothed wheels. The invention also includes other novel features, the mechanism being designed to impart increased velocity and power to a rotary shaft with which it is connected.

BALL COCK.—Gaylord S. Hunter, Pawtucket, R. I. This is an improvement in hydraulic safety valves, such as are used for automatically shutting off the supply of a tank of any kind. It has a casing held in the wall of the tank, and when the water rises to the required height it lifts a float and tilts a lever to close the valve firmly upon its seat. The construction is such that, if the float or lever should be broken, the head of the water would close the valve. The device may be adjusted to automatically shut off the supply at any time, and it is designed to keep itself clean from rust or scale.

LAST.—Arthur M. Leighton, Port Townsend, Washington. This is an adjustable cobbler's last, automatically adjustable to closely fit any size of boot or shoe, no matter whether it has a pointed or wide toe. A reach bar having a locking notch connects the toe and heel sections of this last, a spiral spring wound around a portion of the bar bearing against the heel section. When the last is placed in a boot or shoe the several parts are expanded by the spring, which is released by pressing a catch on the outside, the last then completely fitting the boot or shoe, ready for the workman.

Agricultural.

PLOW.—Frederick S. Moore, Hanford, Cal. This plow is especially adapted for use in vineyards and orchards. The beam is pivoted to the forward part of a share-carrying frame, a short distance from its inner end, in which is a longitudinal slot, while an angle lever fulcrumed on the frame has on its inner end a pin working in the slot of the beam, there being between the handles a rack with which the upper end of the lever engages. With this construction the draught may be quickly and easily changed from right to left by the plowman, so that the near or off horse of a two or three horse team can walk in the furrow, and so throw the shares of the plow closer to a tree or vine than would otherwise be possible.

HAY SLING.—James M. Kellogg, Bozeman, Montana. The carrier of this device consists of a pole from which is projected a series of ropes terminating at their outer ends in rings or loops, and all adapted for attachment to a trip mechanism, a back rope having both ends secured to the pole being also connected with the tie rope of the trip mechanism. The hay or straw may be carried by this device from the delivery spout of a thrashing machine to the place where a stack is to be formed, the load not being dumped or spilled out except as it is placed in the desired position.

BRANDING TOOL. — John R. Todd, Glenrock, Wyoming. This implement consists of a tube with pointed ends, in which slides a plunger, while there is an adjustable gauge on the tube. The pointed end of the tube is plunged into an animal, and then a tag previously placed in the tube is driven inward through the tube by the plunger, the tag being left in the flesh under the hide after the tube is withdrawn. The tag cannot afterward be removed without mutilating the animal, being found in the beef only as it is marketed.

Miscellaneous.

BICYCLE TIRE.—George R. Bassett, New York City. This is a pneumatic tire on which is a tread piece, with two separate cushions between the wheel rim and tire, and a fibrous envelope around the cushion rings and between the tread piece and pneumatic tire. The improvement forms a detachable shoe, readily removable, partly or entirely, when desired, and preventing injury to the inner pneumatic tire.

BICYCLE ATTACHMENT.—Allen Marthens, Pittsburg, Pa. This is a simple device for automatically locking the steering fork, and which may be readily released when necessary to bring the steering wheel under the complete control of the driver. A spring lock normally engages the fork to hold it from rotation in its sleeve, the lock having a vertical arm held from lateral movement, while a laterally movable swinging bearing member is carried by the fork and engages the lock rod, and an operating lever engages the bearing.

CARRIAGE BRAKE.—Philippe Brailly, Bellaire, Ohio. The brake beam of this device is journaled in vertical bearing blocks resting upon a transverse spring, in connection with which are an operating rope and guide pulleys, a winding drum, foot levers, pitmen, and intermittent gripping devices, forming a brake readily operated by foot power, and in which all the operative mechanism is concealed from view and protected from the elements. The connection of the body with the rear springs is also simplified, and the several parts of the brake mechanism are automatically returned to their normal position after the brake is released.

CURRYCOMB.—George W. Neuls, Kane, Pa. The body and teeth of this implement are made entirely of wood, and the grain of the wood runs lengthwise with the teeth, the latter being so tapered that they will be thoroughly effective without producing undue irritation, and without tearing or cutting the hair. The comb is so made as to be very durable and inexpensive, means being provided for attaching the handle to the body in a very solid manner.

BRIDLE.—Alexander and Louis Hasselbauer, New York City. This invention provides a simple and durable bit support, conveniently adjustable to properly fit the animal's head without the use of buckles or similar fastening devices. It consists of a single endless strap doubled upon itself and formed into two cheek sections and throat latch sections, bit-supporting loops being formed at the juncture of the lower ends of the side sections, while a slide or ring connects the throat latch sections above the bit loops, above which also is a nose strap, and a slide or ring connects the upper crossed ends of the cheek and throat latch sections.

COMBINATION TICKET.—Martin Ralph, Queens, N. Y. This ticket has a central continuous web, sufficiently strong to hold the tickets together, but which may be readily torn asunder when necessary, the tickets being separate upon the web, and the loss of time necessary to cut apart being thus saved. The improvement is applicable for railway coupon tickets, or for price or tag tickets, the tickets being provided in the latter case with fastening pins.

LETTER BOX.—Oliver P. Johnston and Calvin M. Gates, Butte City, Montana. This is an improved mail box for the reception of letters, papers and other mail matter, to protect the contents from the weather and keep them from the reach of unauthorized persons. The casing has at its top a letter slot and an opening to receive papers, etc., and a pivoted cap covers the slot and the opening. At one end of the casing is a door, fastened by a hasp and lock.

ELEVATOR.—Lucas M. Kuehn, Wabasha, Minn. This is a device more especially designed for use on large ice boxes and other receptacles, for conveniently elevating and depositing blocks of ice or other articles in the receptacles. It consists of a frame adapted to be raised and lowered on which is mounted to swing a platform that may be automatically tripped to move into an inclined position to deliver the elevated article into the desired place.

SHIFTING DEVICE FOR ELEVATORS. James Flemming, Buffalo, N. Y. A simple and durable device is provided by this invention, more especially designed for grain elevators used to load or unload vessels, and arranged to conveniently shift the elevator leg, to hold it in contact with the grain, The leg is pivoted at its upper end to the frame, while a swinging arm pivoted to the frame engages at its free end the back of the elevator leg, a counterweight holding the free end up against the leg, novel means being provided for operating the swinging arm.

GUN.—Robert A. Steinert, Washburn, Wis. The breech of this gun has a transverse recess in which is mounted a sliding breech-block carrying a spring-projected firing pin engaged by a detent, a cam or incline on the breech being adapted to retract the pin, for which there is also a releaser adapted to release the pin when the breech block reaches its inner or closed position, or which may be moved into inactive position. The construction is simple and durable, and arranged to securely lock the cartridge in place for firing and at the same time actuate the firing pin.

OIL FILTER.—Oskar Lindberg, Helsingborg, Sweden. This is a sectional filter, which may be readily taken apart, cleaned and put up again, and its construction is such that the oil placed in the upper

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portion percolates through various layers of filtering material and strainers, reaching the bottom thoroughly cleansed of all impurities. The filter has a series of valves whereby the flow of oil may be stopped at any desired point in the length of the filter.

HOT WATER HEATER.—Micheal E. Herbert, St. Joseph, Mo. In this heater, all the walls of the fire box constitute a water space, the grate also consisting of water tubes, and a series of drop tubes being arranged in the path of the discharge of the products of combustion, affording a great amount of surface for the absorption of heat. The construction is designed to be economical in fuel and a rapid heater, and the different parts are so arranged as to be light of weight, easy to handle, and quickly connected together, masonry being dispensed with in the setting up. It is designed also to thoroughly burn the smoke and gases, and to be easily cleaned.

LAMP CHIMNEY COVER PLATE.—James H. Hunt, Massillon, Ohio. This is a plate of non-combustible material, preferably mica, with a central aperture of less diameter than the lamp chimney, and fitting over its top, another plate sliding in guidee being adapted to increase or diminish the draught. The device is designed for attachment to any kind of chimney, and by adjusting the pressure until the flame stops smoking a compact, even and dense light is produced, of much greater volume than the same pressure will produce with the plate removed.

CHIMNEY RACK.—Nehemiah H. Brown, Norwich, N. Y. This is a show rack for supporting the chimneys so they will be well displayed to view and readily accessible. It consists of a rotating cone having pins set at an angle in its side, a base and shaft supporting the cone.

RACK FOR HATS, ETC.—Howard U. Ackerman, North Indianapolis, Ind. This device has a wall board with enlarged openings for the passage of pins and their lugs, and the rack comprises a series of brackets each formed with hooks and connected by rods to each other to form a shelf.

SASH-CORD FASTENER.—Margaret J. Hufman, Ashland, Pa. This device consists of a box or casing to be secured in the upper ends of the stiles of each window sash, the box having an open outer side, a slot in its outer edge at the top, and pins, a hinged cover, and a double latch. When it is desired to remove the sash from the window, it is pulled out of its guideways, the lid of the box is swung, and the cord readily removed from the casing, so that the sash is disconnected, and can be moved away as may be desired.

CASH RECORDER AND DRAWER.—Lloyd M. Mills, Grand Rapids, Mich. This is a machine arranged to print on a tape a record of all sales made, and also print on a tape a detachable ticket indicating the individual sale. The device has a suitable casing in the bottom of which slides a money drawer, the locking bolt of which is connected with a lever. By the use of ten keys the operator can record any sale from one cent to a hundred dollars, the recording tape remaining inside the locked casing, and a corresponding coupon for each sale being cut off by a spring-pressed knife.

BOOK OR COPY HOLDER.—Barney Gardinier, Chippewa Falls, Wis. This is a simple device to support copy or a book at a distance above a table, in such position as may be desired. The device is capable of quick and convenient manipulation, and when not in use may be folded to occupy but a small space.

AUTOMATIC ADVERTISING DEVICE.—Theodore B. Hafertep, Chicago, Ill. An exhibitor for use in public conveyances is provided by this invention. It consists of an endless band supported to move longitudinally on a bracket frame projecting from the side or roof inside the vehicle, the band carrying advertisements in series, and motion being communicated to it from the car axle, so that when the car is moved in either direction all the advertisements on the band will be brought into view.

DISINFECTING APPARATUS.—Emil and Salomon Taussig, New York City. The graduated discharge of a disinfecting fluid in places needing such treatment is the object of this invention. The device is simple and inexpensive, and can be automatically actuated to allow the escape of the fluid, which is retained from discharge by hermetically sealing the containing vessel above the fluid that will flow from below when the partly established vacuum produced by such sealing is broken, and air admitted to equalize pressure of the atmosphere above the fluid and at the point of discharge.

ELECTRO-THERAPEUTIC PROCESS AND APPARATUS.—Joshua M. Wardell, Cadillac, Mich. This invention provides a process and an implement to facilitate injecting a fluid into the vaginal canal, and then applying an electrical current to and disseminating it through the fluid.

Designs.

SPOON.—J. S. Rathbone, Mystic, Conn. The handle of this spoon has a configuration and ornamentation representative of the golden rod, and inclosing a bust-like figure of Washington, while the bowl is ornamented by a shield.

Another design for a spoon by the same inventor also utilizes the golden rod in a similar manner, but the handle has on the front a different bust-like figure and on the back a shield, while in the bowl is a representation of an eagle.

SCARF PIN.—John G. Brokaw, Somerville, N. J. The head of this pin is an oval ring having ornamental appendages, a disk representing an eye, another disk showing a heart, and intermediately a representation of clasped hands, while a laterally curved bar is arranged on one side of the oval ring.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE CALIFORNIA VINE DISEASE. A preliminary report of investigations. By Newton B. Pierce. Washington: Government Printing Office. 1892. Pp. 222.

This monograph is an excellent exemplification of the solid work done by the Department of Agriculture of Washington. It is excellently printed and illustrated, some colored prints being especially worthy of notice. It has a very long index, and, if it may be accepted as a pledge of the work to be done by that department in the future, it will have the tendency to make all farmers wish well for the last of the federal departments.

ENERGY AND VISION. By S. P. Langley. National Academy of Sciences. Vol. V. First memoir. Pp. 18; 4 plates.

In commencing his paper the author says: "While it is quite a familiar fact that the luminosity of any spectral ray increases proportionately to the heat in this ray, and indeed is but another manifestation of the same energy, I have recently had occasion to notice that there is on the part of some physicists a failure to recognize how totally different optical effects may be produced by one and the same amount of energy, according to the wave length in which this energy is exhibited. I have undertaken, therefore, during the last few months, an experimental reinvestigation of this subject with such a statement especially in view." The experiments are very interesting to those who are fond of advanced physics and reflect great credit upon this eminent scientist.

NATURE STORIES FOR YOUNG READERS. Boston: D. C. Heath & Co. An instructive little book for young people. Price 30 cents.

LE REGIME DES EAUX A LILLE. Etude sur l'Hygiene et l'Assainment des Villes. By Ange Descamps. Publication of the Société Industrielle du Nord de la France. 8vo. Pp. 140. Maps and plans.

This report is chiefly interesting to civil engineers, and we might remark to the engineers of Lille, for the work is of purely local interest. The Lillois are evidently extremely well pleased with their water supply, their sewers—and themselves.

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1. Elegant plate in colors, showing a very attractive dwelling at Warberth Park, Pa., erected at a cost of $4,150 complete. Floor plans and two perspective elevations. John Robinson, architect, Germantown, Pa.
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3. A colonial residence at Newton Highlands, Mass. Perspective view and floor plans. J. W. Beak, architect, Boston. A picturesque design.
4. A pretty cottage erected at Bridgeport, Conn., at a cost of $1,600. Floor plans, perspective, etc. A. M. Jenks, architect, Bridgeport, Conn.
5. A dwelling house erected at Warberth Park, Pa., at a cost of $4,478 complete. Mr. C. W. Macfarlane, architect, same place. A model design. Floor plans and perspective.
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7. A residence in the "Colonial" style of architecture, erected at St. David's, Pa. Perspective view and floor plans. Cost complete $5.800. F. L. & W. L. Price, Philadelphia, architects.
8. A residence on Golden Hill, at Bridgeport, Conn. Perspective elevation and floor plans. D. R. Brown, architect, New Haven, Conn. An excellent design.
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THE ENGINEERING RECORD (Prior to 1887, the Sanitary Engineer). Published Saturdays. 277 Pearl Street, New York. 12 cents a copy.

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Wanted—Engineers and pilots. Twenty licensed engineers and pilots to run small passenger steamers for the summer months of 1893, in connection with the World's Fair. Sober, steady men are invited to write us for further information. Chas. P. Willard & Co., Clybourn and Southport Aves., Chicago, Ill.

The *Engineering Record*, the recognized authority on municipal and building engineering, has recently been enlarged by the addition of a department in which notable industrial plants are regularly described and illustrated, the steam and power plants being a conspicuous feature. Recent publications include the great Ivorydale plant of Messrs. Proctor & Gamble, described in 23 columns and illustrated by 57 drawings. The steam plant at Ivorydale is separately treated in 13 columns and 31 drawings. The new foundry of Henry R. Worthington, at Elizabethport, N. J., 16 columns, 26 illustrations. National Meter Company's foundry and brass finishing shop, Brooklyn, 13 columns, 29 illustrations. Niagara Power Plant (now in process of publication), 6 columns, 6 illustrations. Steam power plant of the Dwight Manufacturing Co., Chicopee, Mass., 9 columns, 7 illustrations. Machinery Hall steam power plant, 8 columns, 6 illustrations. Published Saturdays. 12cents a copy. The *Engineering Record*, 277 Pearl St., New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(4617) R. L. B. asks: Who was the inventor of the friction match? A. It is said M. Derosne made a friction match with a phosphorus tip in 1816. An impetus was given to the match industry by the Dobereiner lamp, and in 1827 the first really practical friction matches were made by Mr. John Walker, a druggist of Stockton-on-Tees. They were known as "Congreves," and consisted of wooden splints or sticks of cardboard coated with sulphur and tipped with a mixture of antimony sulphide, potassium chlorate and gum. Each box contained 84 and they were retailed at a shilling. With each box there was supplied a folded piece of glass paper, the folds of which were to be tightly pressed together when the match was drawn through them.

(4618) R. F.—To become a first class electrician or electrical engineer, you will need, first of all, a good mathematical education. If you have not a good education, you can of course secure it by studying the ordinary school books. If you are well up in mathematics, the rest is simple and plain. By studying electrical books you can acquire a knowledge of electricity. Latin, while it is desirable, is not absolutely necessary to an electrical engineer. We would suggest the following books for your use: "Experimental Science," Ayrton's "Practical Electricity," Thompson's "Dynamo Electric Machinery," Kempe's "Hand Book of Electrical Testing," Lockwood's "Electrical Measurements," Sloane's "Electrical Arithmetic."

(4619) R. M. F.—German silver has 13 times the resistance of copper. It requires of No. 16 copper wire 234¼ feet for the resistance of 1 ohm. As stated above, it will require only 1-13 of this amount of German silver of the same size for 1 ohm. With this as a basis, if you know the resistance of your lamp, you can make the necessary calculations.

(4620) W. P. C.—You can make your moulds of wood or metal. If you intend to use them a great deal, it would, perhaps, be well to make them of hard bronze. Your clay cylinder should first be dried in the open air, then heated slowly to a red heat and kept at that heat for several hours. It requires experience to judge when the work is done. We would suggest the purchase of a work on pottery.

(4621) O. J.—There is very little action in the battery referred to when the circuit is open. Carbon pieces can be granulated, and pulverized and moulded together after being mixed with a little flour and molasses and then baked. See "Experimental Science," for information on moulding carbons. For points on nickel and silver plating consult SUPPLEMENT, No. 310.

(4622) T. J. R.—If most of the lines of force pass to the armature as indicated by your sketch, it serves to render the core more magnetic and thereby increases the efficiency of the machine. It is not definitely settled that it is advantageous in all machines to provide teeth as suggested.

(4623) W. Z. writes: We have a private telegraph line of 12 instruments, each wound to 20 ohms resistance. Could we run the line with a dynamo? Will it be less expensive than batteries, considering that we construct the dynamo ourselves, and also have free use of water power to run it? A. You can operate your telegraph line by means of a dynamo, but we think a battery would be preferable for a small installation, as it is always ready for use.

(4624) J. F—The only suggestion we can make in regard to your belt is to wet it evenly all over, stretch it until it is straight, and allow it to dry, afterward filling the leather with some of the dressings used for that purpose. We think, however, it will be better for you to write to the manufacturers of the belt. They may have more simple treatment.

(4625) C. L. S.—If you have placed the poles of your dynamo on an iron base, you cannot expect it to work as a dynamo, and it would not be a success as a motor. Place the machine of a wooden or a brass base, and you will find it will behave quite differently.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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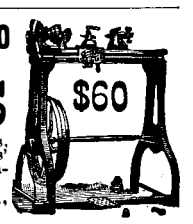

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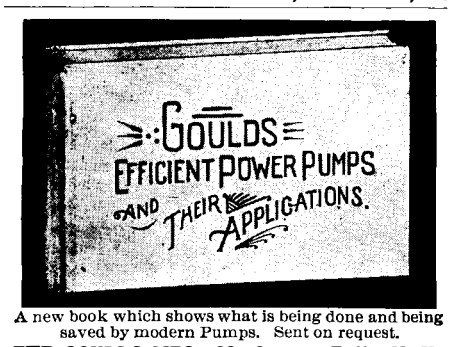

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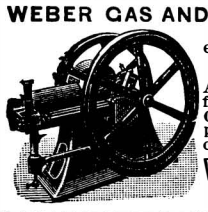

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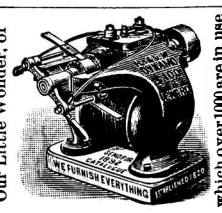

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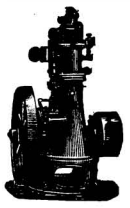

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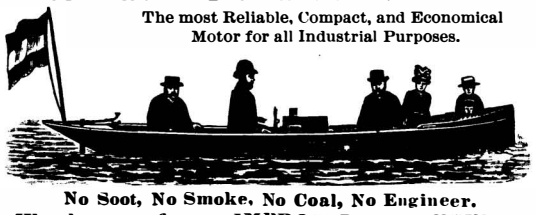

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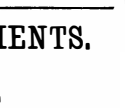

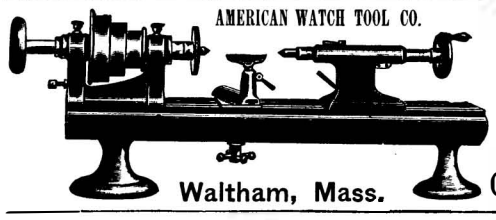

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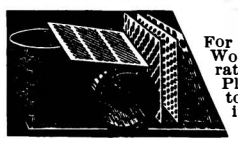

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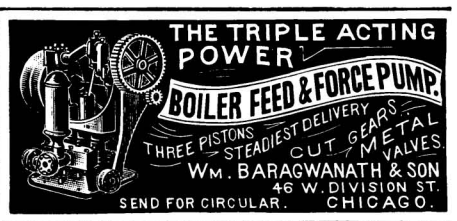

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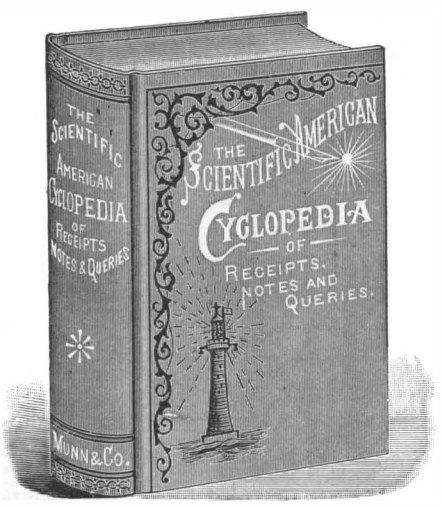

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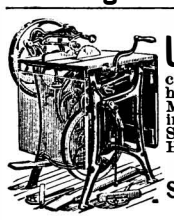

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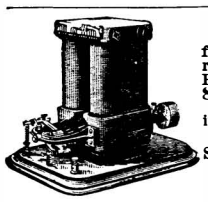

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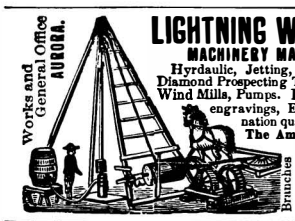

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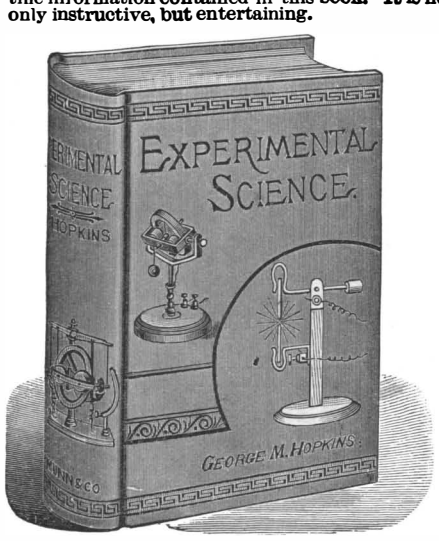

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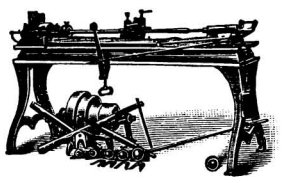

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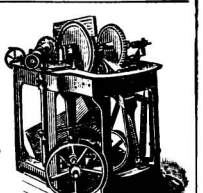

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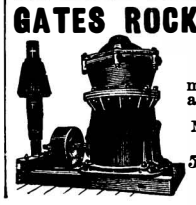

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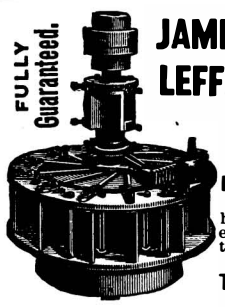

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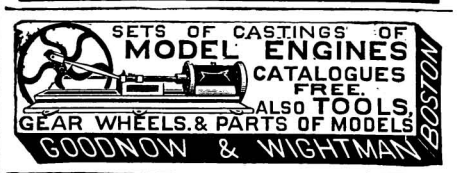

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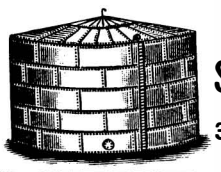

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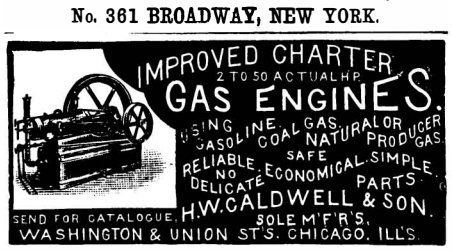

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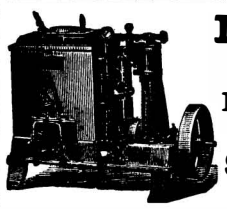

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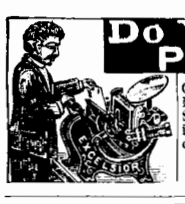

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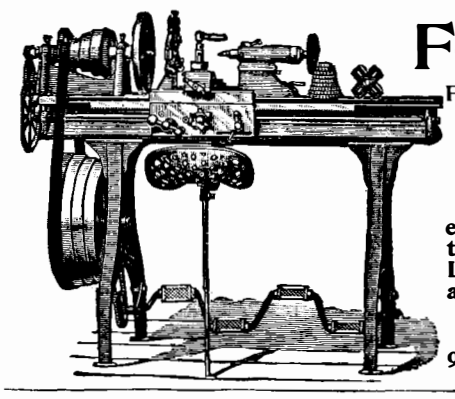

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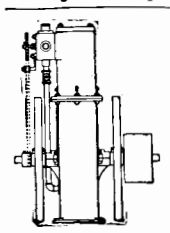

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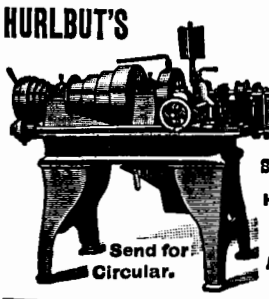

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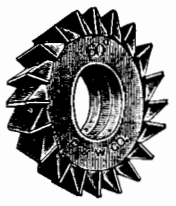

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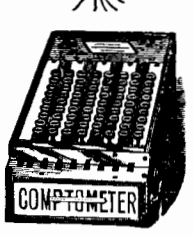

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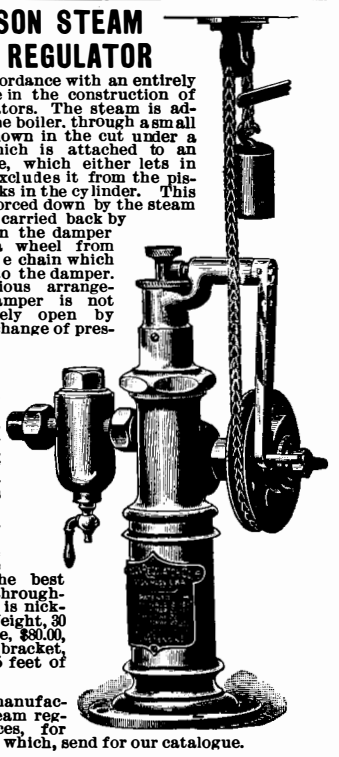

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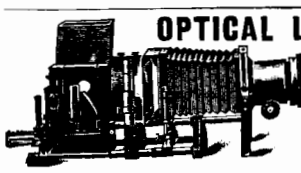

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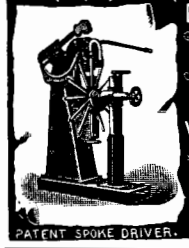

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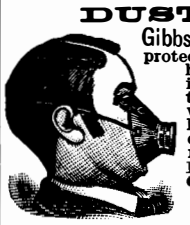

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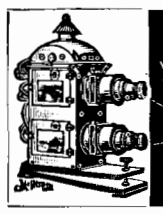

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WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti, O.

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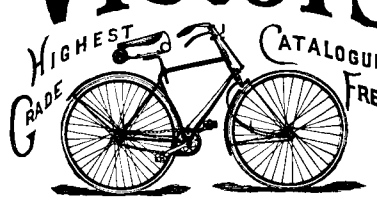
Victors



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BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.
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CHICAGO. NEW YORK. PHILADELPHIA.

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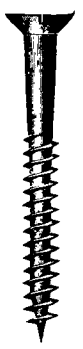

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☞ Send for samples to

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ESPECIALLY SOLICIT ORDERS FOR SOFT AND EXTRA SOFT PLAIN BLUE FINISH OR ANNEALED OR PICKLED
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GREAT ACCURACY OF GAUGE WIDTH AND UNIFORMITY OF QUALITY WILL ALWAYS BE MAINTAINED
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COLD ROLLED SHEET AND STRIP STEEL
FOR DIFFICULT PRESSES, STAMPED, DRAWN WORK &c.

UNEXCELLED BECAUSE OF ITS SMOOTHNESS OF SURFACE, ACCURACY AT GAUGE, GREAT DUCTILITY & STRENGTH, GENERAL UNIFORMITY AND FREEDOM FROM GRIT.
FURNISHED IN ANY WIDTH FROM 1/2 TO 6 INCHES AND THICKNESS FROM 3 INCHES TO 300 GAUGE. ALSO ANY DEGREE OF TEMPER AND QUALITY OF SURFACE.

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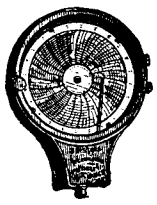

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Makes a continuous record, day and night, of Steam, Water, Gas, Air, and Liquid Pressure.
Will pay for itself by insuring Safety and Economy in the operation of your plant.
Simple in construction, accurate in operation, and low in price. ☞ *Send for circular and facsimile chart.*
The Bristol's Mfg. Co., Waterbury, Conn.

It winds up like any good stem-winding watch, in about five seconds.

Honest it always was; now it is handsome---with jeweled movement, enamel dial, coin-silver or gold-filled case; either lady's or gentleman's watch. Far better than any Swiss watch at the price. That is still low—kept down by American machinery and brains.

Ask your jeweler about it—The new *quick-winding* "Waterbury." 13

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BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building near 7th Street, Washington, D. C.

Westinghouse Electric and Manufacturing Co.

PITTSBURGH, PA., November 30, 1892.

LAMPS—Efficiency, Long Life. No Decrease in Candle Power.

SOCKETS—Simple, Ornamental, Reliable, Cheap.

Our New Lamps not only do not infringe the Edison Patent, but they are fully covered by patents of our own.

By means of an important discovery the burner is rendered stable, its efficiency increased, its life prolonged, and its normal candle power maintained.

PRICES.—By reason of economies effected in the manufacture of our new lamp in large quantities by the use of special machinery, we are able to quote the following low prices:

25 and 20 Candle Power Lamps.....$0.35 List Price
16, 10 and 8 Candle Power Lamps..... 0.30 List Price

DISCOUNTS.—Central Stations, 10 p. ct. discount; and to all others, 2½ to 10 p. ct., according to quantity.

ALLOWANCES.—A credit of ten cents will be given for every unbroken burned out lamp delivered at the factory of the Company. The saving by decreased cost of lamps and renewals should equal nearly one per cent. on the capital stock of any central station.

The constant efforts of the agents of the General Electric Company to induce our customers to exchange Generating Apparatus of our make for Thomson-Houston Generating Apparatus is fully explained by the fact that **THE THOMSON-HOUSTON COMPANY PAYS US**, through the Consolidated Electric Light Company, Five Cents for every Incandescent Lamp it makes, for the right to sell such lamps for use in connection with Generating Apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston Generating Apparatus, the present users of the same may avail themselves of our new lamp by substituting our Generating Apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE.—**A dealer** came to our office and stated that he had the **exclusive sale** of second hand apparatus for the **General Electric Company**; and he offered five of our Number One Alternating Current Generators for sale, to be delivered a few weeks hence, as they are still in use. **We can of course commend this apparatus if in good order.**

An official of a central station Lighting Company approached us recently for the exclusive right to the use of our apparatus in his town, stating that his company had already entered into a contract Form D, with the General Electric Company for the exclusive use of their apparatus. He frankly avowed that his purpose was, by securing a contract with us, to have a monopoly of electric light and power in the district covered by his station.

WE THOUGHT IT BETTER TO LEAVE THAT PLACE OPEN FOR COMPETITION.

We have also been informed that one other company had executed Form D contract of the General Electric Company. These three are the only instances we have discovered where they have succeeded in doing business in the direction of inducing users of our apparatus to discard it for apparatus made by members of the Trust.

Although we have many tons of apparatus made by the various members of the Trust, taken in the course of trade, we have not cared to offer it for sale, for we believe the sale of inferior apparatus does great harm to the electric trade in general.

We have perfected devices that can be inserted in the various sockets now in use, thereby making them standard, for the use of our new lamps The manufacture of these in sufficient quantities to meet the demand has been unexpectedly delayed, so that the delivery of lamps and these attachments will be made only from and after January 1.

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SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's ☞ Book of **SAWS**, new 1892 edition. We are first to introduce NATURAL GAS for heating and tempering **Saws** with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address **EMERSON, SMITH & CO. (Limited), Beaver Falls, Pa.** **SAWS**

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Applied to Pulleys, Gears, Sprocket Wheels, Reversible Countershafts and Cut-off Couplings. The most simple, effective, durable, and economical Clutch on the market. Made in sizes to transmit from 2 up to 1000 h. p., at slow or fast speed. Over **10,000** in use. ☞ Write for cuts, description, price list and discounts.

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READILY ATTACHED OR REMOVED BY ANY ONE.
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We are prepared to take contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
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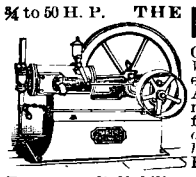
¼ to 50 H. P. **THE**



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AN UNUSUAL BUSINESS CHANCE.

The American Automatic Amusement Machine (Gipsy Fortune Teller), is the best paying investment ever offered. Results show that a small investment brings large returns. State and County rights for sale. Machines supplied, no expense, no loss, all profit. **American Automatic Amusement Machine Company, 123 South 7th Street, Philadelphia.**

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Embodies the most Progressive Mechanical Principles.
All the Essential Features Greatly Perfected.
Perfect and Permanent Alignment.
Easiest Running, and Nearly Silent.
All type cleaned in Ten Seconds without Soiling the Hands.
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We have 20 branch offices in the principal cities throughout the United States.

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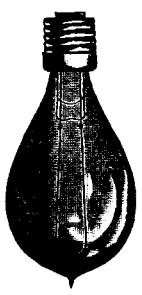

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All others infringe the Edison Patents, and are counterfeits.

See decision of Court of Appeals in case of Edison Electric Light Company *vs.* United States Electric Light Company, decided October 4, 1892.
Copies of this decision will be sent on application.

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The Junior • Kodaks • are the most compact camera made. Perfectly adapted to hand or tripod use. Can be used with **roll films or glass plates.** Fitted with focusing index and counter for exposures.

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95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

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A neat model of the most powerful weapon of war, which dictates peace to all nations. This toy is built on a scale about one inch to a foot, can be used in any parlor. For holidays nothing gives more amusement to boys than one of those Toys; are entirely harmless and will even interest scientific men.

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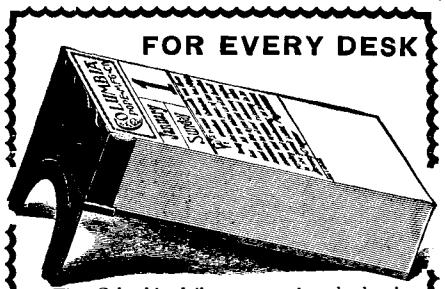
FOR EVERY DESK



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